

A Hayden Publication

January 1983 \$2.50

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\$2.95

PERSONAL COMPUTING

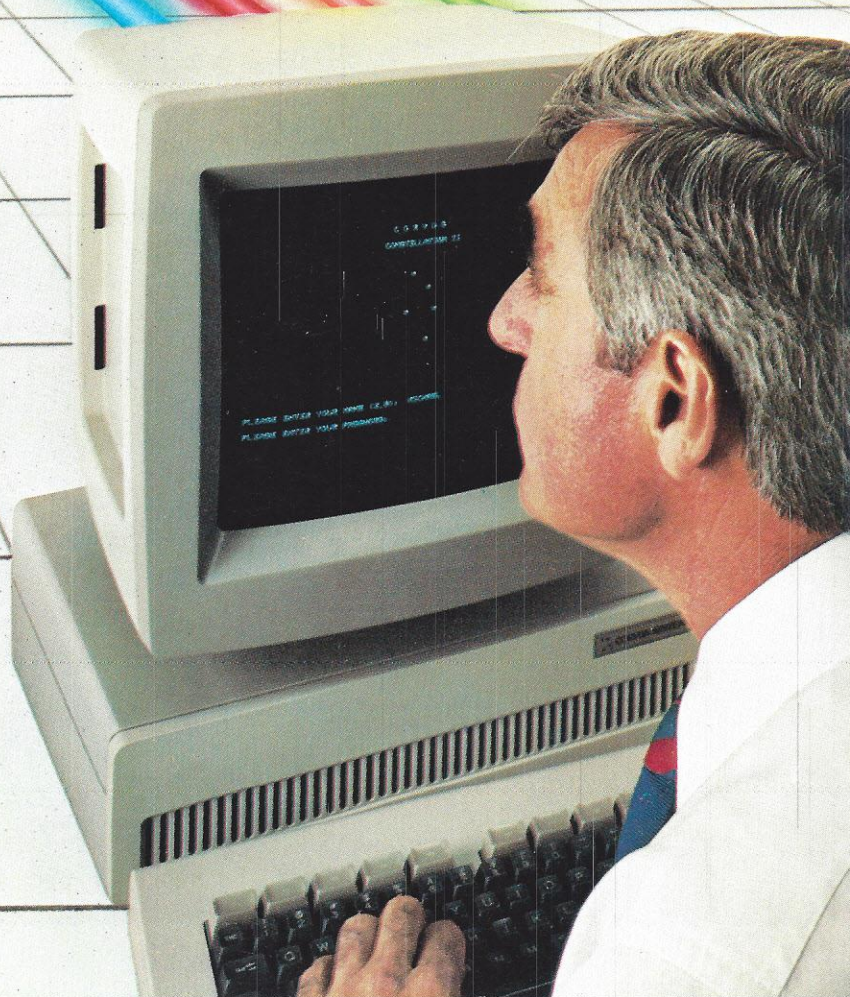
NETWORKING:

A Powerful Tool
For Personal
Communication

A Special Report On
Hard Disk Drives

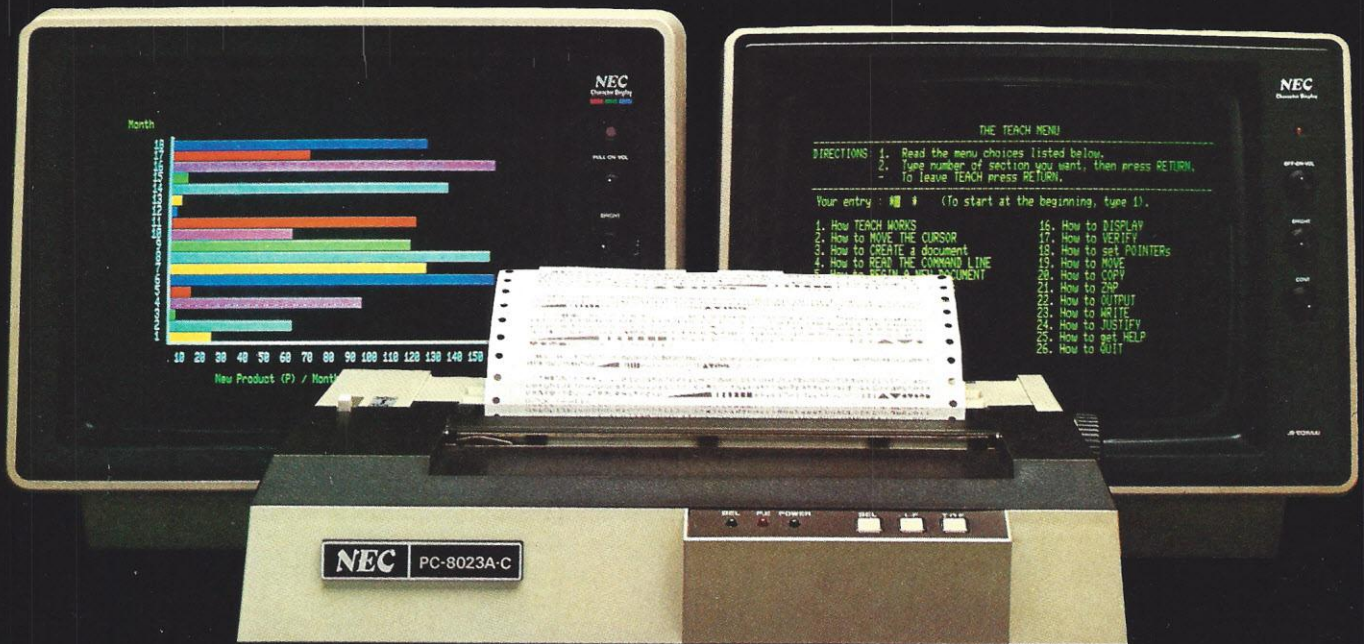
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Creativity Via
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Computing Your
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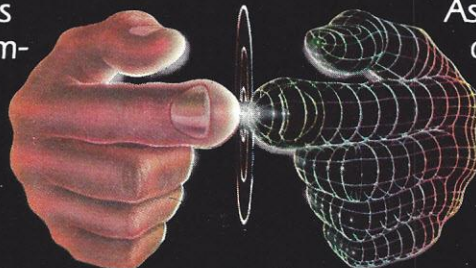
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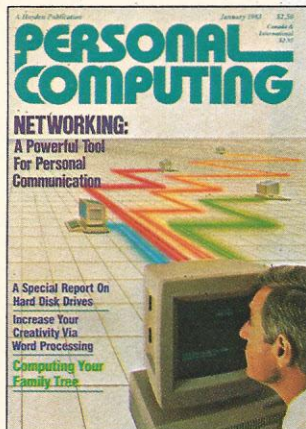
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MOUNTAIN COMPUTER
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FEATURES



By allowing the free exchange of information through pooled resources, while still retaining the independence that is at the heart of personal computing, local area networks represent a major turning point in the evolution of the industry.
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GEORGE B. FRY III

COVER ILLUSTRATION
CHARLES MIZE

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Networking: A Powerful Tool For Personal Communication

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Sifting lots of data is what traffic engineering is all about. Here's how personal computing produces different kinds of answers to problems with many hidden subtleties.

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PROFESSIONAL/MANAGERIAL

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Word-processing programs are more than efficient productivity tools. They also let writers tap deeper into their wellsprings of creativity.

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ADVANCED

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Making a four-function calculator out of a personal computer isn't as simple as it seems at first blush. In developing Desk Master, the solution to this problem meant writing a minicomputer.

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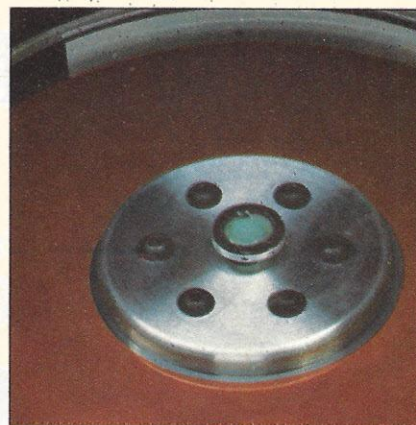
Bright ideas can produce profitable results, but costing out the idea process is complex. Here's how one firm—using a personal computer—is generating the necessary data for job costing, and saving money at the same time.

BUSINESS

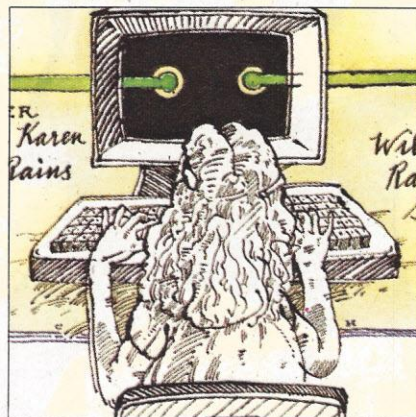
Data-Base Management Systems: The New Bedrock Of Business

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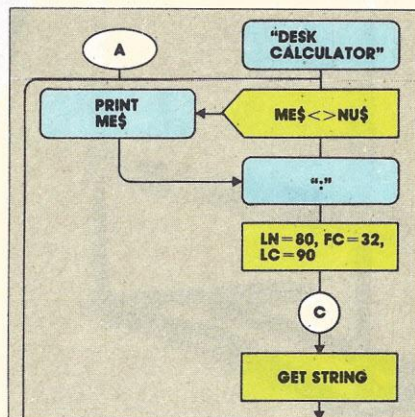
Whether it's a full-scale relational system or a simple filer, a DBMS gives you instant access to a complete data bank—without the need to maneuver around the corporate mainframe time schedule.



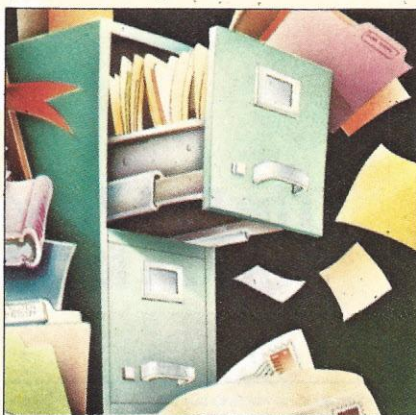
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How to go for the gold.



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CIRCLE 3

4 PERSONAL COMPUTING January 1983

COMING IN FUTURE ISSUES

Drawing The Line

Computer graphics—a maze for the uninitiated... or is it? February's cover story explodes the myth that graphics on a computer are not for the faint of heart. We'll plot a course that will lead you to simple, easy-to-use ways to put this exciting tool to work—and in the process, you'll learn to draw yourself a better bottom line.

Damage Control

What happens to your hardware and software in the event of a fire? The question is: Is anything salvageable? There are some surprising answers in this story, answers that will give you valuable tips about what to do in case the unthinkable happens to you.

Winning Design

The America's Cup race, where the fastest 12-meter yachts in the world will pit hull and sail against the elements—and each other—will also be the setting for another kind of contest. The British entry will be hoisting computer-designed sails, convinced they'll have the winning edge. It's a story filled with the kind of technical insights and know-how that make it must reading for anyone interested in designing with a personal computer.

Rural Compute

The Renaissance man—aloof, self-sufficient, independent. It's a kind of life that seems all but impossible in our super-heated, hi-tech society. But one man is proving that it is precisely because of hi-tech that it's again possible to live out of the mainstream. It's one man's dream come true—and perhaps, a road map for others who have looked longingly at the woods.

Dating The World

There's a group of geophysicists at Lamont-Doherty Geological Observatory in Palisades, N.Y., who, with one Apple, are dating the magnetic history of the planet. Their work, made possible by the mating of a personal computer to a state-of-the-art magnetometer, will extend our understanding of the earth's past, back half a billion years!

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Networking: The Next Step In The Cognitive Revolution

The Cognitive Revolution—the new wave of discovery through which we will think our way out of the final stagnating stages of the Industrial Revolution—is barely off the ground, but gaining the kind of momentum that turns mere speed into profound velocity.

The Cognitive Revolution started when individuals began using their computers as an aid to personal thinking in order to solve problems and to make their dreams come true.

The next step in the Cognitive Revolution—a crucial step—will come as those doing personal computing think together, yet independently. We're talking about more than communicating. We're talking about electronic brainstorming.

That stage isn't quite here yet. Our cover story, "Networking: A Powerful Tool for Personal Communications," page 46, assesses the current situation. But hardware and software are rapidly being developed that will enable those doing personal computing to think together—to think concurrently rather than sequentially.

The machine does stand ready to communicate the results of the thinking that has taken place. Printers generate hard copy. Modems transmit files. Then another human mind has access to the thinking that the first human mind generated, computer-aided.

Compared to personal-communications facilities of only a few years ago, all of this thought-transmission power is light-years ahead of where we were. But sharing thoughts—even with the guy in the next office—still involves transmission delays of one kind or another. The hard copy still has to be delivered, read, responded to. Or the file has to be called up on a screen, annotated and transmitted

back. It's somewhat better than mail or messenger, but it's essentially the same process—electronically dispatched. It isn't thinking together.

If we are to truly think *together*, there are two basic mediums—the telephone and face-to-face. The telephone is handy, particularly for dealing with simple problems one-on-one. But if 10 people are involved in a complex set of interrelated problems, identical sets of masses of data must be at everyone's fingertips at the same time. And there had better be some way to record what takes place.

In that kind of situation it may be better to get everyone together for a meeting at some central location. To do that, calendars have to be rearranged, travel plans coordinated, housing and meals provided. That's networking, in one frantic burst.

Imagine such a problem-solving meeting—but one that has no beginning and no end. The thoughts evolve as minds independently work on them and continuously bring new data to bear. Granted, there is no solution etched in stone, no course to be followed blindly until we meet again. That takes a bit of mental adjustment, to be sure. We're used to rigid paths, centrally prescribed and institutionally directed.

Course correction—continuous course correction participatively arrived at—is a concept that will take some getting used to. And why shouldn't it? After all, human beings up to now have had only limited opportunities to network their minds. The power to do it is near at hand. The power of doing it is explosively exponential.

Paul Kellam

361,633 copies of this issue printed
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Voicing An Opinion On Speech Recognition And Synthesis

In your article, "Voice Command," on page 50 of the November 1982 issue, you stated that Centigram "until recently made speech-recognition systems." This comment is true, as far as it goes, but it leaves the impression that Centigram is no longer in the voice business. This is not true. We have simply redirected our efforts in the voice-synthesis field with real-time vocally development systems for TI and GI synthesizer chips, and with our own board-level synthesizer, LISA.

Since we have already been contacted by one of our major customers expressing concern that we were leaving the voice business, we would appreciate some notice to your readers that Centigram is alive and well and will continue to support our customers, new and old, in the voice-synthesis marketplace.

Thomas E. Rowley
VICE PRESIDENT OPERATIONS
CENTIGRAM CORP.

Let me congratulate you on your excellent article, "Voice Command," on page 50 of the November 1982 issue. However, it contains a few statements that I feel may leave your readers with a false impression.

"Hayden's *Personal Computing* magazine's accuracy policy: to make diligent efforts to ensure the accuracy of editorial material. To publish prompt corrections whenever inaccuracies are brought to our attention. Corrections appear in 'Letters.' To encourage our readers as responsible members of our business community to report to us misleading or fraudulent advertising. To refuse any advertisement deemed to be misleading or fraudulent."

In the remarks by industry spokesmen, the impression was given that in the future a voice-recognition terminal might be built that could run VisiCalc, dBase II and other off-the-shelf programs. The impression was also given that this hypothetical device would sell for under \$1000.

The fact is that the device has been commercially available since January 1, 1982. Called the Shadow/VET, this voice-entry terminal can operate most off-the-shelf software, including VisiCalc, dBase II and THE LAST ONE, as demonstrated at NCC. The unit, which retails for \$995, plugs into a peripheral slot in an Apple-compatible computer, uses no host RAM and requires no software modification. The exclusive KEY-VET feature allows users to use keyboard and voice input interchangeably with standard software.

The industry spokesmen were quite candid about the shortcomings of their own product offerings, but were rather tight-lipped about the advances of their competitors. This is understandable, but it doesn't give readers information on the industry as a whole.

In addition, the voice-based learning system referred to in the article is called the VBLS Authoring System. It sells for \$895 and includes the VET-2 voice-entry terminal.

Keep up the good work on a fine publication.

Brian L. Scott
PRESIDENT
SCOTT INSTRUMENTS
DENTON, TX

MORE USES FOR HAND-HELD COMPUTERS

The article, "Hand-Held Computers: More Than A Curiosity," in the October 1982 issue (page 69), ignored significant areas for such computers and focused on Hewlett-Packard applications in industrial and engineering environments.

There are two other areas that, I suggest, will be of much greater significance for hand-held computers. The first is for the very small business. There are several million small businesses, the kind typically operated from their owners' homes. These owners cannot afford, and really don't need, the power of a tabletop computer. A low-cost pocket computer can handle their paperwork quite easily.

The second reason for buying a pocket computer is as an extension of the calculator. For example, if you have a simple spreadsheet-type problem to handle, it would be most convenient to take your "spreadsheet calculator" out of your drawer and work out the problem much the same way as you would using a calculator.

PocketInfo Corp. is in the business of developing and marketing programs for hand-held computers. We have already developed several programs for the application areas described. I believe your readers would appreciate an article explaining the potential value to them of these low-cost, portable, computing tools.

Arnie Karush
PRESIDENT
POCKETINFO CORP.
BEAVERTON, OR

THE TOMORROWHOUSE FOR TODAY

Your article, "The Smart House Comes of Age," in the October 1982 issue (page 112), will certainly go a long way in telling the personal-computer community that home control has arrived. I would like, however, to clarify a few points for your readers.

Our company name, Compu-Home Systems, Inc., was not mentioned. Readers might like to know that Tomorrowhouse is available for purchase from dealers or directly from us as a self-install kit. It should also be pointed out that the \$3200 price mentioned in the article included an Apple computer,

LETTERS

which many people have already purchased. The kit price, including our 48-channel I/O board, sensors, junction box, heater/AC interface, setup and runtime software, etc., is only \$795.

Moreover, I must disagree with your assessment of Tomorrowhouse as a "future fantasy." Indeed, our goal was to bring the computerized home within reach of anyone today, regardless of his technical ability. I also disagree that Tomorrowhouse is "primitive" in comparison with Joe Winegardner's approach. A close inspection of the user manual will show that we can already do most of what is mentioned in the article (turn on lights if the alarm trips, turn on the stereo, etc.); but with the addition of an \$89 RAM card, we can exceed any product mentioned—any temperature or TTL input can control any AC device or TTL/relay output, for instance.

In addition, Tomorrowhouse has a voice output; a graphical status display; and home-convenience features, such as a memo/appointment calendar, a voice wakeup alarm with time/temp, an out-of-range temperature alarm trip, spa control, up to nine weeks advance heat/air scheduling and extensive customization software for any house. As if that were not enough, we will soon offer remote monitoring and control using voice and any Touch-Tone phone.

Although the article was very descrip-

tive and complimentary, I feel these additions are necessary. Thanks again for including Compu-Home Systems in your story.

Russ Coffman
VICE PRESIDENT
COMPU-HOME SYSTEMS, INC.
DENVER, CO

LETTERS REDEFINED

I have been a *Personal Computing* subscriber for at least two years and have thoroughly enjoyed watching your magazine grow. Your articles reach many levels of expertise, from brand-new users to long-time computer professionals.

I'm most interested in reading your Letters column. I feel that all of us benefit from this interaction with other readers. But while I recognize their right to do so, businesses have increasingly been using your column for advertising. For example, your November 1982 issue contains six letters from people touting a particular product or service. The result is that I now must read ahead to an author's name before reading his letter.

Perhaps you could start a new column in which people could discuss problems, solutions and opinions, and leave the Letters column to complainers (like me) and businesses that were overlooked in a prior month's articles.

Again, I would like to compliment you all on your growth in the past few years.

Your writing is timely and advertising is kept to a reasonable level.

Steven C. Johnson
DALLAS, TX

SOMETIMES IT'S BEST TO GUESS

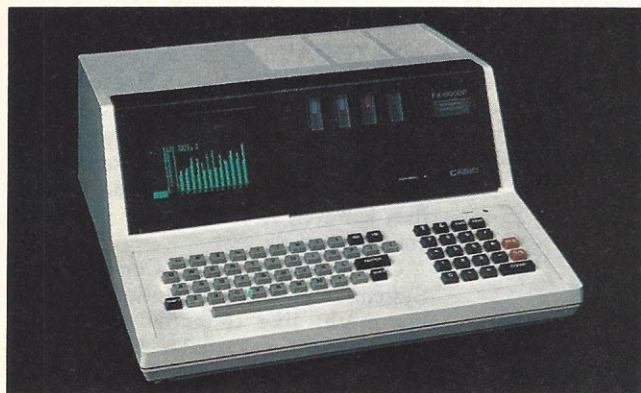
For the sake of the students taking its program, let's hope that the rest of Krell's SAT preparation materials have a better foundation than that provided by the company's instructions for guessing discussed in the article, "SAT Tutoring Programs: Give Them an Incomplete," on page 121 of the October 1982 issue.

The article states that Krell bases part of its instruction on the concept that, "In the actual exam, right answers earn a point, wrong ones lose a point and passes count for nothing." A user of the program states, "But by seeing during the simulated SAT how each stab in the dark cut down their scores, the students got the message. The Krell software made it very clear to them how costly the guessing game can be..."

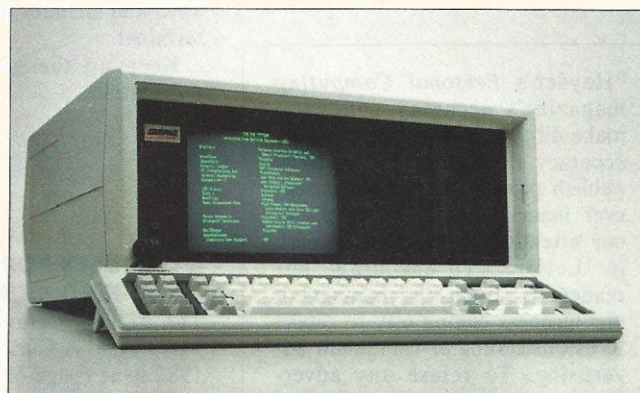
The problem is that the SAT does not penalize students for guessing. This myth continues to be perpetuated by people at the students' expense. The truth is that the SAT uses a formula to eliminate the effect of guessing. To quote College Boards, the publisher of the SAT 1982-83 ATP Guide: "Each correct an-

(continued on page 13)

We goofed! In the December 1982 Hardware Of The Month section we inadvertently ran the picture of the Compaq Portable Computer with the caption for the Casio FX-9000P, and the picture of the Casio FX-9000P with the caption for the Compaq Portable Computer. Below are the pictures with their appropriate captions. Our apologies to both Casio and Compaq.

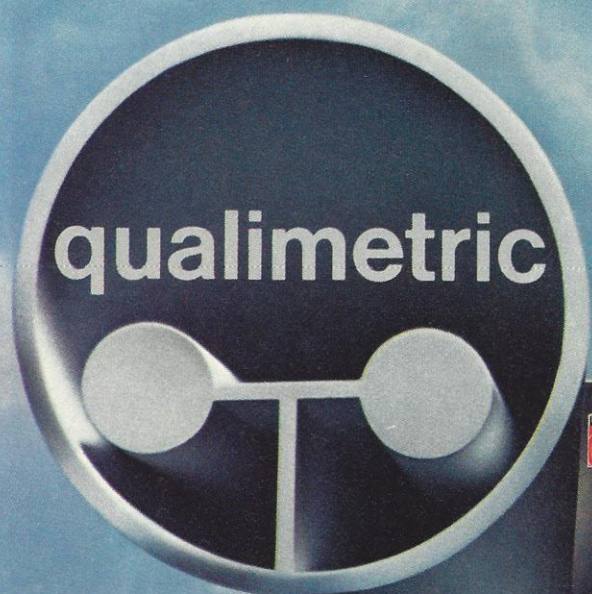


The Casio FX-9000P features 4k slot-in RAMS on which the user can store programs and data for up to three years.



The Compaq portable computer is designed to be truly compatible with the IBM Personal Computer, and costs \$2995.

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CIRCLE 120



If you just bought another computer,
boy are you gonna be sorry.

Epson.

The new Epson QX-10 is unlike any personal computer you've ever seen. It's a computer for people who don't have the time to learn computers; a computer you can be using within minutes.

And fortunately, you don't have to take our word for it. Here's how *Byte*, one of the computer industry's most prestigious magazines, describes the QX-10.

The first anybody-can-use-it computer.

"The Epson QX-10 (is) a computer for less than \$3000 that may well be the first of a new breed of anybody-can-use-it 'appliance' computers ... In addition to being a highly integrated word processing/computer system that offers as much usable processing power as almost any existing microcomputer, the QX-10 ... system is designed to be used by people with minimal technical knowledge. We've certainly heard that claim before, but Epson has delivered on this promise in a way and to an extent that no microcomputer manufacturer has done."

That's nice to hear from a magazine like *Byte*, of course, but it doesn't surprise us. It's just what we intended the QX-10 to be all along.

More computer. Less money.

But useability isn't the only thing the QX-10 has going for it. As *Byte* says, "the QX-10 gives you a great deal for your money."

"Help is available at any time through the HASCI (Human Application Standard Computer Interface) keyboard Help key ... Text can be entered at any time just as you would in a conventional word processor. The Calc key turns the system into a basic

4-function calculator. Graphics can be created via the Draw key. The Sched (schedule) key gives you access to a computer-kept appointment book, a built-in clock/timer/alarm, and an event scheduler."

Advanced hardware for advanced software.

As for hardware, *Popular Computing*, another industry leader, says: "The QX-10 includes ... a number of advanced hardware features ... The basic components of the system are a detachable keyboard, a high resolution monochrome display, and a system unit containing two 5¼ inch disk drives. The drives use double-sided, double-density disks (340K bytes per disk) and are amazingly compact ... The QX-10 uses an 8-bit Z80A microprocessor. The system contains 256 bytes of RAM. Some of the RAM is ... battery powered ... which lets the computer retain information when the power is off."

You won't have to wait much longer.

The new Epson QX-10 may very well be the computer you've been waiting for. And fortunately, you won't have to wait much longer — it will be appearing soon in computer stores all across the country. In the meantime, write Epson at 3415 Kashiwa Street, Torrance, CA 90505, or call (213) 539-9140. We'll be happy to send you copies of our reviews.

After all, as *Popular Computing* puts it, the QX-10 will "do for computing what the Model T did for transportation."

And we couldn't have said it better ourselves.



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(continued from page 8)

swer receives one point and no points are assigned to omitted questions. A correction for guessing is then applied. For questions with five answer choices, one-fourth of a point is subtracted for each incorrect response; one-third of a point is subtracted for incorrect responses to questions with four answer choices."

In our computer materials for helping students prepare for the SAT (the ADAPT Program for the SAT), we let students know that the proper test-taking strategy for the SAT is to guess at everything. The logic behind that strategy is that if a student knew nothing about the SAT, probability dictates that guessing has no value. But students know lots of things about questions for which they don't know the correct answers. They may be able to eliminate wrong answers or simply have an intuitive sense of what might be correct. Therefore, probability dictates that a guess at every answer will not lower students' scores and, in fact, will raise scores any time students know anything at all about the items.

Paul Geisert
PRESIDENT
INSTRUCTIONAL SYSTEMS, INC.
WASHINGTON, DC

A MEMORY PRODUCTS UPDATE

I read with great interest and anticipation your article, "More Computer Muscle to Power the Machine," on page 88 of your October 1982 issue. Since the article was about memory systems, and peripherals in general, I was looking forward to seeing mention of the broadest based peripheral manufacturer in the country to date: Microtek. However, it wasn't even mentioned—not even in the buyer's guide.

Microtek has been making peripherals for four years now and has some 30- to 40-odd products that interface with the Apple, the IBM Personal Computer and the Atari and Commodore machines. So to set the record straight, we would like to outline some of the more obvious oversights and fill your readers in on the appropriate details.

A few of the products that we manufacture include: a 16k RAM card for the Apple II with MOVE DOS and memory-management software; a 64k and 128k RAM card with VisiCalc expansion software; a 128k Q-DISC disk-emulation

system with VisiCalc expansion software; the Dumpling-64 Fast Spooler that handles text and graphics for all major printers; the HAL series of IBM Personal Computer memory-expansion boards (from 64k to 256k); and disk-emulation and spooler software for the IBM Personal Computer, which transforms all RAM cards into additional function blocks, as required.

We also have a program to enhance VisiCalc in a preboot fashion. Neither Axlon nor any other company has an exclusive on disk emulation. Giving the impression that Axlon is the only firm in that field is misleading. Further, Quadram and Practical Peripherals do not have an exclusive on dedicated RAM printer spoolers, as your article implies. We have printer spoolers for both the Apple and the IBM Personal Computer.

Thank you in advance for your response.

Winn Schwartz
DIRECTOR OF SALES AND MARKETING
MICROTEK INC.
SAN DIEGO, CA

SOME INPUT ON SOFTWARE

Thank you for your commentary about IUS' new spreadsheet software program, EasyPlanner, in your September 1982 Software of the Month section (page 240).

However, please allow me to make a correction. Apparently, at the time of the magazine's release, the price for the software was \$195. It has now been changed to \$250. As I'm sure you will agree, it's still a bargain at this price.

We appreciate your kind words, and if we can be of any further assistance to you or your readers, please don't hesitate to contact us.

Kathleen Biklen
MARKETING COMMUNICATIONS MANAGER
INFORMATION UNLIMITED SOFTWARE
SAUSALITO, CA

RAPID WORD PROCESSING FOR MODEST MACHINES

I would like to comment on a letter that appeared on page 8 of your November 1982 issue. The letter was written by William M. Tatam in reference to your article, "Word Processing for Personal Computers," on page 82 of the August 1982 issue.

This letter was written on my 8k VIC 20 (under \$400) using a word-processing program called RAPIDWRITER (on tape, under \$40). It was printed on an Epson MX-80 dot-matrix printer. Even with a 22-character-per-line screen, three full lines of text appear on the screen and I am able to print correspondence on standard-size paper.

RAPIDWRITER is new and is a product of HD Manufacturing, Inc., of Leverett, Mass. It can print text lines in the left-hand margin, print in a condensed style, move sentences and even paragraphs easily, and it has all of the more ordinary editing features.

Finally, I agree with William Tatam that more attention must be given to the thousands of us who want word-processing capability for our modest systems. This will enable us to dump our old-fashioned typewriters.

David J. Miner
GREAT NECK, NY

A ROSE BY ANY OTHER NAME

In the Answers column of the September 1982 issue (page 14), a discussion of portable personal computers described the Hewlett-Packard HP-85 as being "very compact," but "at the expense of having a cassette drive for memory instead of a disk drive."

As an owner/user/programmer of both TRS-80 and HP computers, I can testify that describing the built-in digital tape drive of the HP-85 as a "cassette drive" is rather like calling a Mercedes-Benz "basic transportation."

The tape-drive operating system of the HP-85 supports both serial and random access files, produces files that are fully compatible with the disk operating system and stores approximately 210k. Moreover, the specs of this machine include typical search-speed/access time of 7800 bytes per second, typical transfer rate of 650 bytes per second and rewind time of 29 seconds (140 feet of tape). Both drive and cartridges are durable and reliable. While tape is slower than disks, the tape cartridges are less delicate to transport.

Incidentally, VisiCalc, accounting, word-processing, statistics and some excellent graphics/plotting software are all available for the HP-85.

Valerie Vann
THRESHOLD SOFTWARE, INC.
SACRAMENTO, CA

Monitor Resolution Imposes Restrictions On Display Width

In this monthly column, "Answers," we will respond to your most frequently asked general questions about personal computing. Please send your questions to: Answers, Personal Computing, 50 Essex St., Rochelle Park, NJ 07662.

Q: Why do some personal computers, such as the Apple II, display only 40 characters per line? Most of the new computers feature 80-character lines in their displays.

A: Some personal computers, including the Apple II, are designed to be hooked into your television set. American television uses broadcast standards that, if used to display common business data, would give us a dim, fuzzy image. If that doesn't seem right to you, just try hooking up an 80-column computer to a TV screen. You'll see what we mean.

Since the Apple is a computer that is designed to be hooked into your TV, it generates a display a TV can accommodate legibly—40 characters long. This is called a 40-column display. The depth of the display is measured in lines. So a 40-column by 21-line display is 40 characters wide and 21 lines deep.

The Apple's keyboard and display width are derived from Teletype conventions. There are also several other computers with narrow-width displays, including the 20-character Commodore VIC 20 and the 64-character TRS-80 Microcomputer Model III.

Today, no computer designed to use a TV for its display shows more than 40 characters across. If you

want to show more data, you will have to go to the expense of purchasing a high-bandwidth monitor. (Bandwidth is a measure of the sharpness of the picture.) Sharp, contrasty, fast-changing images (such as those seen with some word-processing or graphics software packages) require a monitor whose cost (sometimes several thousand dollars) is more than what is normally considered to be affordable in "family" computing.

Many designed-for-TV computers can be outfitted with 80-character, line-width display electronics, usually on a PC (printed circuit) board plugged into an expansion slot inside the computer. This board costs several hundred dollars, but with it you will have a professional-quality, 80-column display (for which you must then buy a \$100 to \$300 high-resolution monitor).

Why stop at 80 columns? Well, the current generation of monitors and computers has its limits. Computers with 132-column displays (good for financial work) cost approximately \$5000, but it's tough staring at 132 columns on a conventional 12-inch screen. For a wide display featuring normal-size characters, you may wind up paying in the \$8000 range for a computer, or you could spend several thousand dollars on a wide-display monitor or terminal for your present computer.

Q: I have been shopping for a home computer for several months. I've conducted much of my search by reading the available publications. I'm leaning toward the Com-

modore machines, but I'm afraid the VIC 20 doesn't have enough memory for my purposes. On the other hand, a dealer told me that the Commodore 64 doesn't have any available software yet. Do you think I should go for the VIC 20 or wait six months for the 64?

A: To begin with, your dealer was wrong. Not only does software exist for the Commodore 64, but this system can also use some programs designed for the VIC 20. However, if you find that not enough software is available for your needs at this time, we think that computing is such a great thing that you shouldn't wait. You really won't lose anything if you go with the VIC 20.

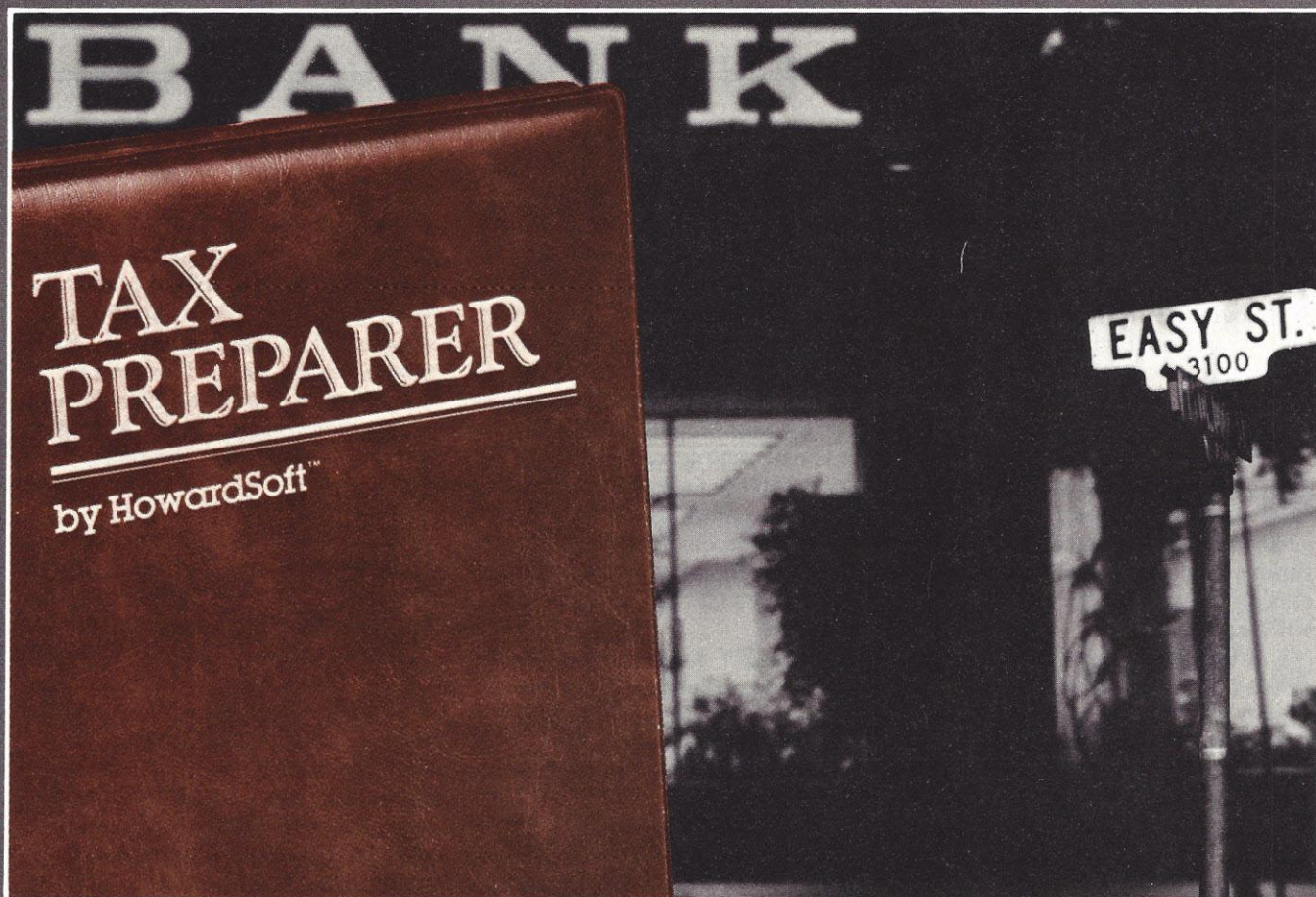
First of all, while it may be true that the VIC 20 has a small memory compared to your potential applications, it's probably also true that you won't need a great deal of memory for the computer right off the bat. If you feel that more memory is a must, there are several manufacturers that can provide it. You can find many of them in the Commodore user's magazines that you'll start receiving once you purchase the computer.

By getting the smaller computer, you can start right now on your computing. Then you'll have a number of months in which you can find out just how useful the little machine is. If, after that time, you decide you really need the added memory of the 64, and if the software you want becomes available by then, you can go ahead and spring for that one. You're not talking about a super-high price tag for either of these machines, although the 64 is more expensive than the VIC 20.

Now you're probably wondering

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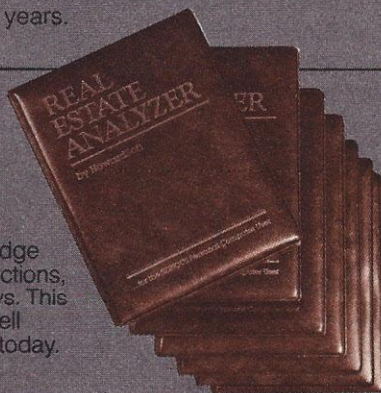
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what on earth you'd do with the VIC 20 if you later decide you really need the 64. Well, there's a wealth of educational software available for the machine, lots of games and some down-to-business packages as well. You could use the smaller computer for a communications terminal, a home manager, a teaching aid—the list is almost endless.

Q. I'm thinking of getting a small portable computer, maybe even a hand-held or pocket computer, to do various functions including word processing. How small a display can I still find useful?

A. Forty columns by four lines may be a practical minimum display for lengthy word processing. Less than that is fine for memos—even the VIC 20 has a 20-column word-processing program available—but most creative work necessitates being able to see what you've just written, and 40 by 4 provides that capability.

You can experiment by duplicating various formats on a computer with a 40-column by 21-line display to see what you can live with, using 40 by 4 as a baseline. You may find that a smaller display is fine for supplementary word processing, but you might also want a personal computer with a larger display to meet your everyday word-processing needs.

Q. I have been told that calculators work just as well as personal computers for most math work. Is this true?

A. Small calculators do their job very well. They tend to be more convenient than a computer for the day-to-day discrete calculations most people need to do.

Most of today's computing systems allow you to use only one program at a time. Thus, if you need to do a calculation and the program you're using lacks a calculation function, you

have to exit the program, do your calculation in BASIC or in another program, then reload the program you were using. Under those circumstances you might be better off having a calculator by your computer.

The latest computing systems allow more than one program to coexist in RAM. With these new systems you can access a calculation program or your BASIC language without having to exit your current program. But that capability only exists with a few computers and programs. Until such computers become more widespread, you'll find the calculator a very practical accessory for your personal computer.

For higher math work, though, computers are superb. Programs currently exist to do algebra, calculus, statistics, trigonometry and other math functions on many personal computers.

Q. I know that I can't place my floppy disks close to scissors or other metal objects that might be magnetized, as this could destroy the information on the disk. What about bank safe-deposit boxes? Can I use them safely? Or am I unnecessarily concerned?

A. You are unnecessarily concerned. It's true that magnetic fields can alter or erase the information stored on floppy disks. But the magnetic field has to be of a fairly high strength. That imprecise measure really means that a device intended as a magnet could damage the information contained on the disk. It's unlikely that some tool that had been accidentally magnetized would have a strong enough field to cause alteration of the magnetic material on the disk. It is a good idea, though, to avoid objects such as those you described. They could be magnets. The more likely danger is that their sharp points could scratch the magnetic material, causing loss of data integrity.

The other part of your question con-

cerns bank vaults. Vaults are probably the safest places to keep your data. Many data-processing companies store archival copies of their records—on disk or magnetic tape—in vaults. The outside metal box of the vault itself provides a terrific magnetic shield. Magnetic fields can't penetrate the vault. If your disk is inside a safe-deposit box, that's even better. We've never heard of a safe-deposit box that was a magnet.

Q. While shopping for a hard disk drive, I noticed that some of these units have fans built in and others don't. Are the ones with the built-in fans better than the ones without?

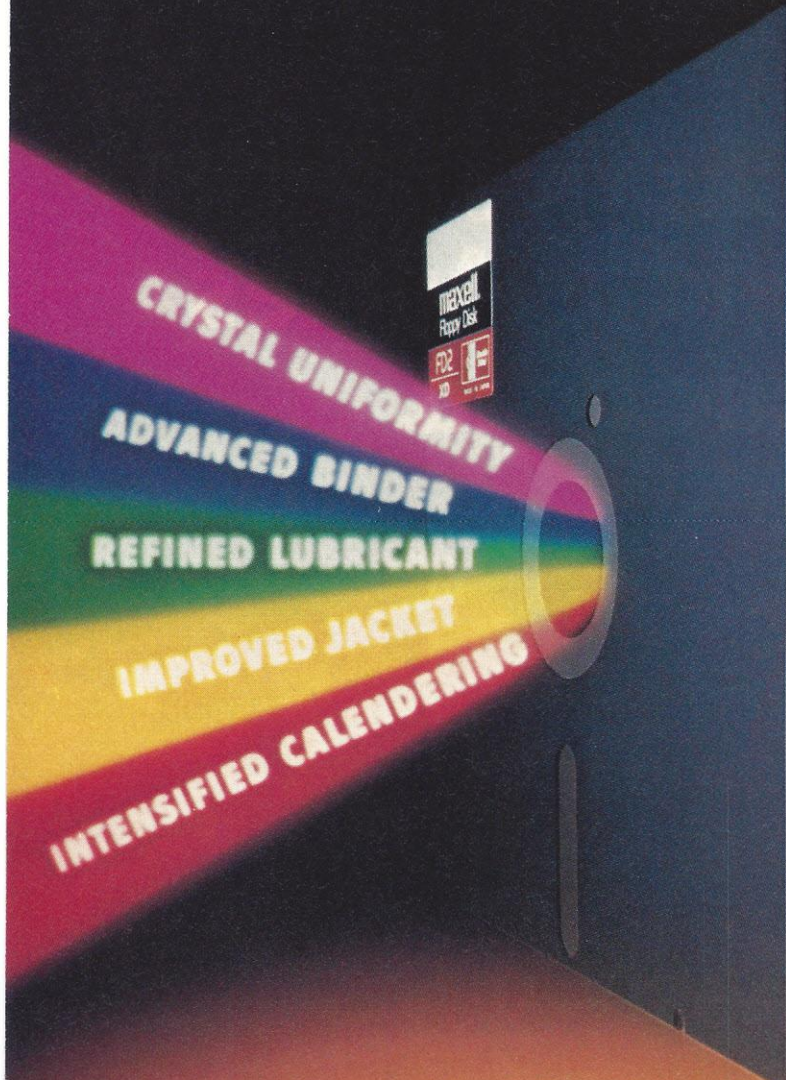
A. Hard disk drives, like other electronic systems, generate heat. This heat has to be removed one way or another. To illustrate some heat-removal methods, let's discuss two different systems. But understand that the way the heat is dissipated doesn't matter—what matters is that the device doesn't overheat.

Take the Xebec Kit (Sunnyvale, Calif.) hard disk drive that is housed in a roomy, perforated metal box. This drive works fine as long as it is set up so air can circulate freely around it. The open design of the drive does let dust in, however, so you need to clean the dirt out occasionally. Too much dust can cause overheating.

On the other hand, the Apple ProFile hard disk drive is completely covered and uses bottom and side venting. As the air inside the box is heated, it rises and leaves the drive from the side vents, pulling cool air in through the bottom.

Since the ProFile is more tightly shrouded than the Xebec, it uses heavy, finned hunks of metal called heat sinks for further heat dissipation. Metal easily conducts heat, and finning maximizes the heat-conducting surface area. This, combined with convection cooling, ren-

(continued on page 21)



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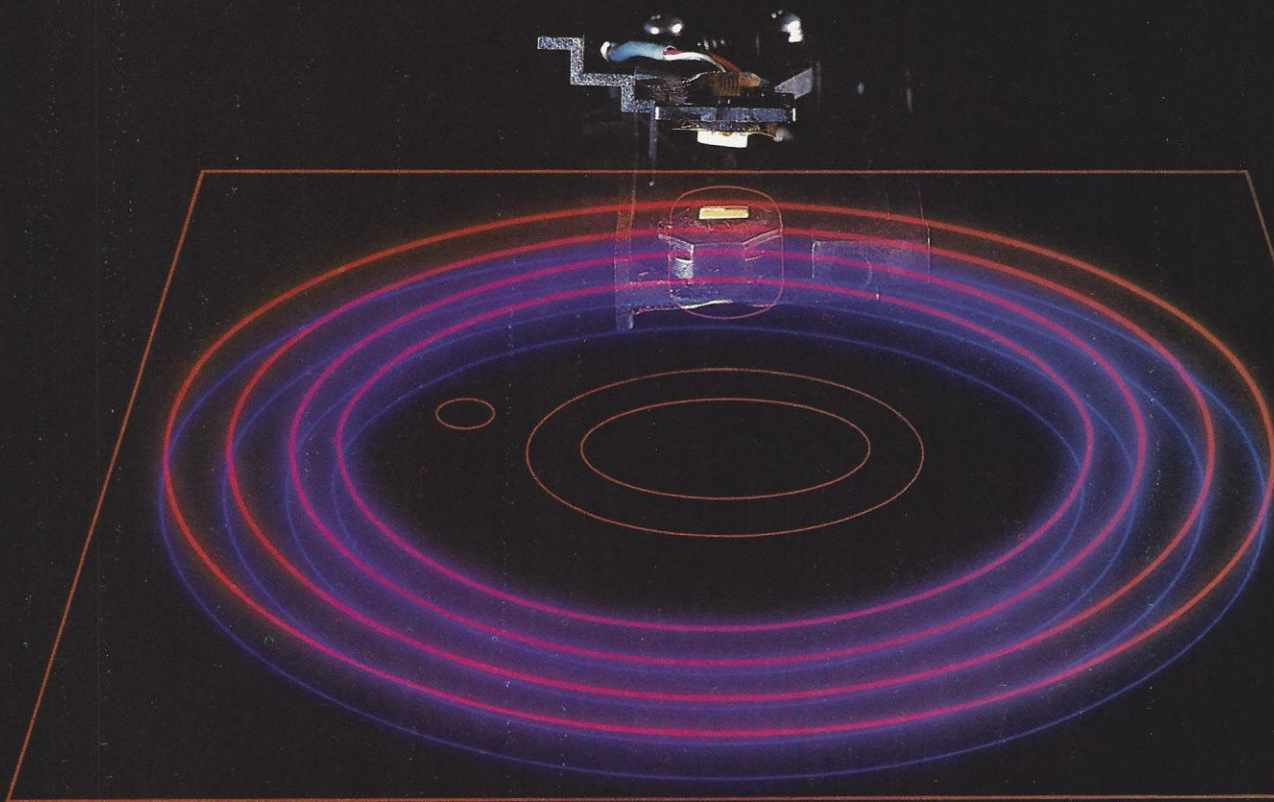


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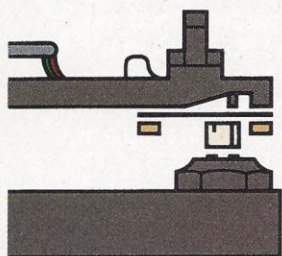
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Now we have two.

We added another head so you won't have to buy another disk.

That's the beauty of a double sided head. A floppy disk which allows you to read and write on both sides. For more storage, for more information,



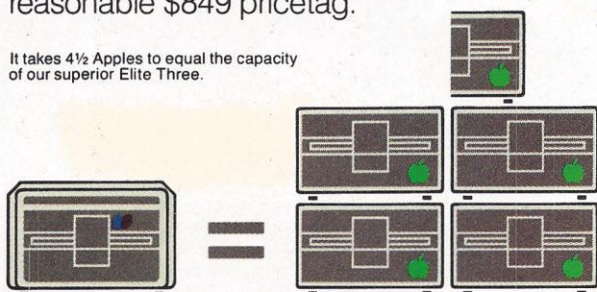
Rana's double sided heads give Apple II superior disk performance power than second generation personal computers such as IBM's.

for keeping larger records, and for improved performance of your system. That's what our new Elite Two and Elite Three offers. It's the first double headed Apple® compatible disk drive in the industry. And of course, the technology is from Rana. We're the company who gave you 163K bytes of storage with our Elite One, a 14% increase over Apple's. And now with our high tech double sided heads, our Elite Two and Three offers you two to four times more storage than Apple's. That's really taking a byte out of the competition.

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We designed the Elite Three to give you near hard disk capacity, with all the advantages of a minifloppy system. The double sided head operates on 80 tracks per side, giving you a capacity of 652K bytes. It would take 4½ Apples to give you that. And cost you three times our Elite Three's reasonable \$849 pricetag.

It takes 4½ Apples to equal the capacity of our superior Elite Three.



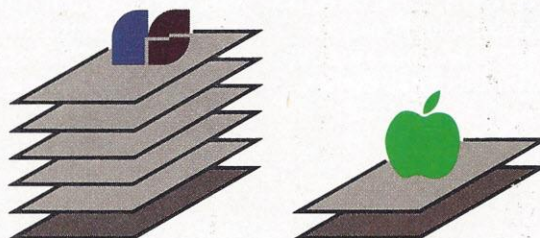
The Elite Two offers an impressive 326K bytes and 40 tracks on each side. This drive is making a real hit with users who need extra storage, but don't require top-of-the-line capacity. Costwise, it takes 2½ Apple drives to equal the performance of our Elite Two. And twice as many diskettes. Leave it to Rana to produce the most cost efficient disk drive in the world.

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Our double sided head may be an industry first for Apple computers, but nobody was surprised.



They've come to expect it from us. Because Rana has always been a leader. We were the first with a write protect feature, increased capacity,



Your word processor stores 5 times as many pages of text on an Elite Three diskette as the cost ineffective Apple.

and accurate head positioning. A first with attractive styling, faster access time, and the convenience of storing a lot more pages on far fewer diskettes. We were first to bring high technology to a higher level of quality.

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a wide variety of options to set your communication parameters — as well as change hardware configuration — directly from the keyboard. It even allows you to generate ASCII characters that are normally not available from Apple

keyboards, further extending your capabilities. Incoming data can be printed (on serial or parallel printers) as it's displayed on your screen.

Micromodem II is available with or without the Terminal Program. Buy your modem by itself, or optionally packaged with the Terminal Program disk and user manual at extra cost. The software is also sold separately, for those who already own a Micromodem II.

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(continued from page 16)

ders the ProFile as reliable as any of its fan-mounted competitors.

In the final analysis, the sophisticated design of the ProFile probably costs as much as a similar drive that contains a fan. Therefore, you probably won't save money by going fanless. The difference will be in the complexity of the design and the noise it produces.

Q. What does it mean when they say a computer has a clock function built in, or that I can buy a clock card to stick in it?

A. A computer usually executes your commands as you give them. A computer with a clock executes your commands at whatever time you set it to. For instance, a computer with a clock is capable of transmitting messages to distant sites during the early morning hours at low telephone rates while you sleep. It can also keep an appointment calendar that beeps to warn you that something important is coming up. Software to realize these possibilities is just being developed and disseminated, so "can" and "does," in this case, are still far apart. Fundamentally, a clock will add the time factor to the functions you want the machine to have.

Q. I saw an ad from Cuesta Systems for backup power for personal computers. It said that the IBM Personal Computer requires a 200 W unit, while the Victor 9000 needs a 90 W unit. How come? Does the IBM computer have more capability?

A. It's generally true that the more power an electronic device uses, the more capability the device has. General rules, however, are often untrue in specific cases. This is the situation here.

Dave Dickey, president of Cuesta Systems and the designer of the DATASAVR, the product you saw

advertised, recommends particular DATASAVERS for different computers based on tests the company ran on these computers.

For the IBM Personal Computer, the lowest power consumption Cuesta found was 106 W. That's for a minimum system configuration of the computer, one disk drive and the black-and-white monitor. Add more peripherals to the computer, and it sucks down more power. Memory is a big power user, but electro-mechanical devices, such as disk drives, are gluttons, too.

When Cuesta tested the Victor 9000, it found that this particular computer used less power than the IBM Personal Computer. With the standard built-in monitor and two double-density disk drives, the Victor 9000 was always drawing under 90 W when running. Hence, Cuesta recommends its 90 W UPS (Uninterruptible Power Supply) for the Victor 9000.

Which leads us to ask, rhetorically, just what is a UPS?

A UPS is a device that keeps your computer running when the power your local power company provides shuts off unexpectedly. This can happen, as everyone knows, when the weather gets nasty or when someone plugs in the electric heater on the same electrical line your computer is using. (This happened to us one day, in fact. A 300-line document disappeared into never-never land as the circuit breaker popped because someone in the office was cold.)

Big UPSs have a motor-generator set and a battery. The motor runs the generator that charges the battery. When the power goes off, the process is reversed, and the generator, turned by the motor that is powered by the fully charged battery, supplies AC electricity to the power grid of a computer room, for example.

UPSs for personal computers aren't that elaborate. They usually consist of a battery and some electronics. The electronic circuits

charge the battery and monitor the incoming power. If everything is OK with the power input, then the UPS merely passes it on through to the computer that's plugged into it.

When something goes wrong, though, the UPS swings into action. On the Cuesta units, for example, when the incoming voltage drops to 102 V, down from a nominal 110, the unit goes into UPS mode. It switches a device called an inverter onto the line. The inverter takes the DC voltage supplied by the battery and turns it into AC voltage, which the computer needs to keep going. The system keeps monitoring the power line, of course; when the voltage is back to a certain percent, the UPS switches itself out of the line and allows the power company's power to flow to the computer once again.

The UPS will keep the computer running long enough for you to at least save whatever you're working on so you won't lose it. Generally speaking, the bigger the UPS, the longer it will keep the power level up.

You can estimate the size unit you need by looking at the power rating affixed to your computer. Dickey says this number is conservative, so you generally can take a unit smaller than the power rating of the computer. In fact, says Dickey, you can almost cut the manufacturer's number in half and then get the next larger UPS. Or the manufacturer of the UPS you're considering will probably know which of his models work with which personal computers.

You might think you don't need a UPS at all. Dickey says that until a few weeks ago he told people they could get by without one, if they were willing to put up with saving data frequently. That's when he got a call from a writer in Silicon Valley who had four power-line "hits" in one day. When they started, the writer started saving his work onto disk frequently, which worked until the last hit, which came as his computer was updating a disk directory. Some noise got

ANSWERS

through to the drive, and the disk was rendered unreadable.

The problem is even worse with a Winchester disk drive. When an unexpected power interruption hits these units, the disk can't get through an orderly power-down sequence, and the drive might be damaged.

A UPS might provide the kind of data insurance you really need. Cuesta's units cost \$295 for the 90 W model, and \$395 for the 200 W version. The company is located in San Luis Obispo, Calif.

Q: I know that disk drives exist for Atari computers. Can you tell me what kind of disk drive I can use with my Atari?

A: There are two answers to your question—one is general and the other is specific.

The more general answer is that you can hook up any drive you want to the Atari computers. The problem isn't in the drive—it's in the controller.

For the most part, floppy disk drives are manufactured by a few drive manufacturers. These companies (two leaders in the field are Shugart Associates and Tandon) either sell their drives to companies called systems houses or to computer manufacturers.

These latter are the companies from whom you usually buy your disk drives. When you get the drive, it's been married up to a disk controller. The controller acts like an interpreter between your computer and the interface electronics inside the floppy disk drive.

Most of the floppy disk drives that are shipped from the drive manufacturers are equipped with a standard interface. This interface takes the information coming from the computer and uses the location information in the data stream to place the actual data on the disk in the right place. The interface controls motor

speed, head position and the like, and activates the heads to read and write.

More specifically, according to Atari, there are at least two different kinds of disk drives you can hook up to an Atari computer. First, there are those sold by Atari itself, which contain all of the controller circuitry inside the drive box. If you want more than one drive, you need an interface box to hook them up. The drives themselves are connected in a daisy-chain fashion, one after another. The whole drive/interface assembly plugs into the side of the Atari computer. Second, there are add-on floppy drives manufactured by Percom, located in Garland, Texas.

So the drive isn't the critical piece of equipment when it comes to hooking one up to your computer. The critical thing is the controller. You could design one yourself, if you had the requisite knowledge of the drive/interface electronics and your computer's electronics. Most of us don't, and most people who do have that knowledge don't care to take the time and trouble. That's why add-on drive manufacturers are able to make a living. They, in effect, customize the drive manufacturers' products to work on particular computers.

Q: I know that CP/M has become almost a standard for business applications for personal computers. Are there any games for CP/M?

A: We first published this question in the October 1982 issue. At that time we professed ignorance of such software and requested information on such products from readers.

The response was, at first, overwhelming. But now readers are warming to the task and, in the process, are taking us to task. One reader, noting our claim of a "diligent search" for CP/M game software, pointed out that Dynacomp was advertising such CP/M-based games on page 85 of the same issue. Clearly, this reader was

more diligent than we. Dynacomp, located in Rochester, N.Y.—(800) 828-6772—says that it indeed offers such games in formats for CP/M-based systems, NEC, Osborne and other computers.


Another reader points out that INFOCOM in Cambridge, Mass., offers two-thirds of the popular personal-computer game Zork, with the third part expected soon in CP/M format. And this reader notes that INFOCOM also has a detective game called Deadline.

Anybody else know of CP/M game software?

Q: I have read so many ads about "user-friendly" computers and software, but when I go into a dealer or try out the equipment, it is far from "friendly." Am I missing something?

A: Not necessarily. Some computers and software packages are much easier for a novice to use than others—partly because their designers have learned with experience how to make them more accessible to new users.

The first personal computers tended to be designed by and for people already knowledgeable about computers and software, and to a novice their instructions could be bewildering. Now, as some manufacturers and software suppliers have attempted to broaden their market to appeal to people whose backgrounds may not include detailed acquaintance with computers, they have taken care to design machines and programs that are more "friendly" to the user.

One rule-of-thumb test as to how "user friendly" a machine or program might be is to try to read the manual or documentation. If you can understand the explanation of each step without undue confusion, chances are that device may be more user friendly than one whose documentation seems incomprehensible. 

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Computers Help Non-Verbal Patients To Speak

As computer power becomes more sophisticated and available to a wide variety of users, people out of the business mainstream are also using the technology to change their lives dramatically. The Department of Rehabilitation Medicine at Goldwater Memorial Hospital, part of the New York University Medical Center, has applied its small Apple II computer to human needs in a distinctly rewarding way.

Edgar, for example, is a 21-year-old cerebral palsy victim who also suffers from dyslexia. Like many other patients using the computer in the Augmentative Devices program at Goldwater Memorial, Edgar is non-vocal, which means he has lost the ability to speak. Although cerebral palsy severely hampers his coordination, Edgar can type words and sentences into the terminal of his Apple computer.

Through a program designed by therapists at the Speech Pathology and Audiology Service, the computer automatically corrects misspelled words, allowing Edgar to communicate with others more effectively. His messages can either be printed out or processed through a Votrax speech synthesizer, which sounds out the words in English.

"We chose the Apple because of the other hardware that could interface with it," says Michael Grossfeld, speech pathologist at the Department of Rehabilitation Medicine. "There is very little software being prepared for use by handicapped people, but whatever is being done is really being made for use with the Apple. Therefore, we found that in order to take advantage of the software market for the handicapped, we would need to get Apples." The department currently uses two of the computers, but the hospital itself has five or six others that they use for different purposes.

Many nonverbal patients are quadriplegic (paralyzed in all four limbs) due to some accident or disease, so they cannot type messages on the keyboard. Like Edgar, their mental faculties are still intact, yet they cannot communicate on their own. Such patients use several methods to enter their thoughts into the computer.

Those patients who have control of their facial muscles use a mouth stick to hit the necessary keys that will compose words and sentences. Others are like Micki, a high-school honors student who was left quadriplegic after contracting a mysterious form of encephalitis at the age of 15. Micki uses a custom-made cheek or chin

switch, activated by very light pressure, to pick out letters to create phrases as the computer scans across the letters on a screen. To counteract fatigue, most patients use both a cheek and a chin activator interchangeably.

"We had Prentke Romich, an engineering firm in Shreve, Ohio, adapt a device to allow us to use scanners with our computers," says Grossfeld. "A scanner is a machine that continually scans the alphabet. The patient can stop it at any point to build words. Essentially, they are bypassing the keyboard of the computer and using the scanner to communicate."

"The computer is, literally, their voice," says Grossfeld. "Many of our patients were in the hospital for years but could hardly communicate with the outside world, even though their intellectual powers were still sharp." Since its inception six years ago, the Augmentative Devices program has treated 200 non-vocal victims of various diseases and trauma.

Therapists at Goldwater Memorial Hospital also use their computers to help patients with aphasia, patients who have language disorders due to stroke-related brain damage. To help them relearn language and improve reading comprehension, the computer asks them simple questions, such as, "What would you do with a razor?" Typically, four answers are given and the patient types in his or her choice. The computer corrects the patient if the answer is wrong, and it uses many visual images to reinforce the relearned word in the patient's memory.

"The aphasic patients enjoy it because they are in control of the situation," says Grossfeld. "They can control the rate of their response to the computer, and they really enjoy the feedback they get from the programs. Using the computer conditions them to respond to the questions correctly."

"We pay close attention to the way our patients spell their words," says Grossfeld. "This helps us work out better strategies to correct their mistakes, which we then enter into the program. It is a constant process of altering and refining."

Each day there are about six to eight patients who use the computers in the speech pathology department. "We have been involved in this program for about eight months, and we still have a long way to go," says Grossfeld. "It took us about six months before we had a number of patients using it."

Grossfeld adds that his patients communicate at an

Videx, a frontrunner in microcomputer peripherals and software, announces two exciting new programs that will make existing software compatible with the 80-column VIDEX VIDEOTERM.

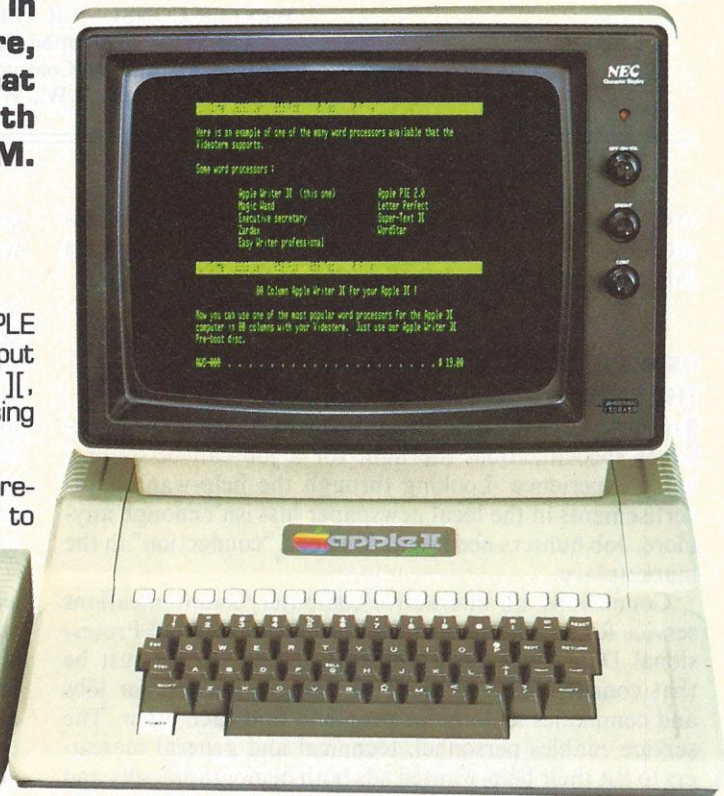
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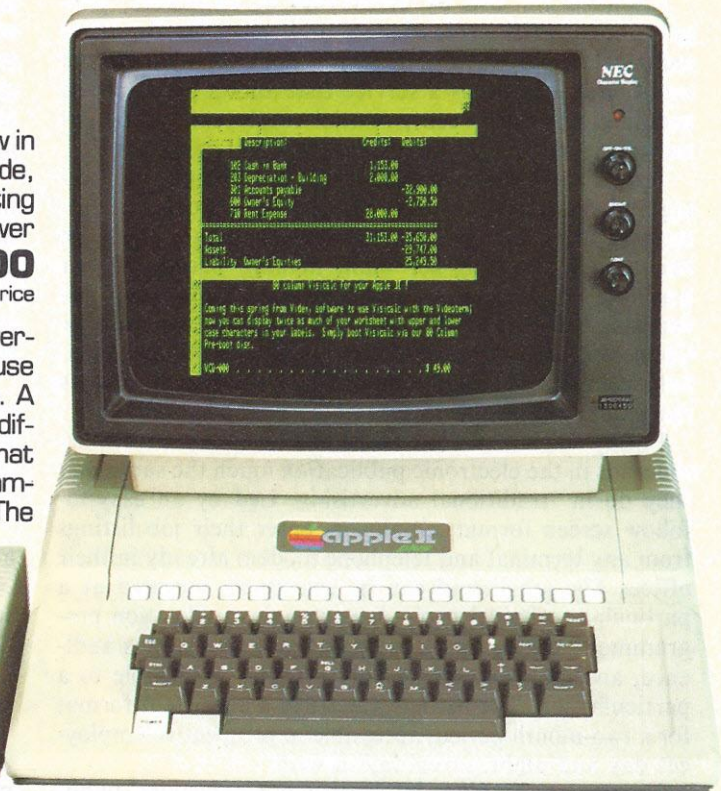
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For those who need even more power, a more advanced version combines all the above features with the ability to use many of the memory expansion boards currently available. A configuration editor allows VisiCalc to use a mixture of different kinds of memory expansion cards. Just tell it what memory cards you have and which slots they are in. For example, you could use more than one language card equivalent. The memory cards can be combined to give you access up to 176 K of memory!

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average of one-twentieth the speed of normal communication. "But," he says, "you cannot imagine the impact this program has on their lives."

USING A "CONNEXION" IN THE BUSINESS TO FIND A NEW JOB

In these days of high unemployment and increased career specialization, the hunt for a job can be quite a hairy experience. Looking through the help-wanted advertisements in the local newspaper just isn't enough anymore. Job hunters need some kind of a "connection" in the marketplace.

Connexions, an interactive computer/communications service for recruiting technical professionals, from Professional Data Corp. in Cambridge, Mass., might just be that connection. It allows both people looking for jobs and companies looking for people to find each other. The service enables personnel, technical and general managers to list their help-wanted ads both demographically and geographically, receive applicants' résumés and then pre-screen respondents with customized questions.

Intended for use by employers of engineers, programmers, MIS professionals and other hard-to-find technical employees, Connexions is not a data base in the traditional sense; it is a service that allows personalized communication between potential employers and potential employees via terminals and personal computers.

Jerry Pinsky, the company's vice president of marketing and sales, explains that the service lets company recruiters reach prospective employees without relying on headhunters, waiting for mail, making phone calls or traveling unnecessarily. "Although traditional print advertising will always be essential," Pinsky notes, "we view Connexions as a complementary medium lending a high-tech, competitive edge, because it reaches and screens more qualified people in less time."

Pinsky explained that recruiters will pay to display their ads in the electronic publication much the same way they do in traditional advertising. Led by an easy-to-follow screen format, employers enter their job listings from any terminal and telephone modem already in their offices. The job listing can be selectively targeted at a particular technical pool—for example, application programmers. By limiting access of the listing to this audience, an employer solicits only résumés applicable to a particular job. The listings appear in a consistent format for a two-month period, accessible to prospective employees day and night, seven days a week.

Employers can place job listings in Connexions' publication for a fee of \$600 per advertisement. "We have companies as large as Wang, Raytheon, Software International and Avco," says Pinsky, "as well as new start-up

companies, such as Lazer Data, that are just putting the walls up."

Potential readers of Connexions include anyone with access to a computer terminal or a personal computer. Job seekers will pay a nominal subscription fee, \$29, to view the electronic publication for between two and three hours per month. From their terminals they can call up job listings, view them and respond electronically with a résumé. "This is not a résumé data bank," explains Pinsky. "Users can control and restrict access to their résumés, assuring that only a prospective employer sees one."

Recruiters then have exclusive access to the résumés submitted. An added benefit is that recruiters can measure the effectiveness of their ads. The number of readers viewing an employer's job listing is electronically tabulated, then compared with the number of résumés actually received on line. The new recruitment service is tamperproof, and the security of all respondents is assured through proprietary software.

"We have found that in high-technology banking and insurance, there is significant dissatisfaction with the high cost and inefficiency of traditional recruitment methods," says Pinsky. "Employers of specialized and experienced technical people can benefit from an efficient channel that reaches their desired audience. This service should let them expand their qualified audience, both in number and in area, without incurring the typical costs."

"In addition, response from technical people has been high. Our readers are comfortable with technology and innovation. They use computer terminals regularly. They're used to accessing data bases," he says. Better than 75 percent of the people who responded to the company's initial mailings use some kind of portable or personal computer.

"People seem to be interested, particularly engineers and programmers who want to conduct a job search in the privacy of their own homes," Pinsky says. "They also have more control over who they see as they operate in the job search market."

According to Pinsky, the service is designed to benefit all areas of high-tech management. "Personnel managers benefit through more efficient use of their time and the subsequent shortened hiring cycles. Technical managers benefit by touching base with qualified applicants within hours of posting positions. And general managers find the key personnel they need to support critical projects."

The company sent out mailings primarily to engineers of all types and to computer-science and programming professionals. "We are concentrating on that aspect of the market, but we are being asked to list jobs for people with financial and even marketing backgrounds," Pinsky says.

"This kind of information exchange is common to secu-

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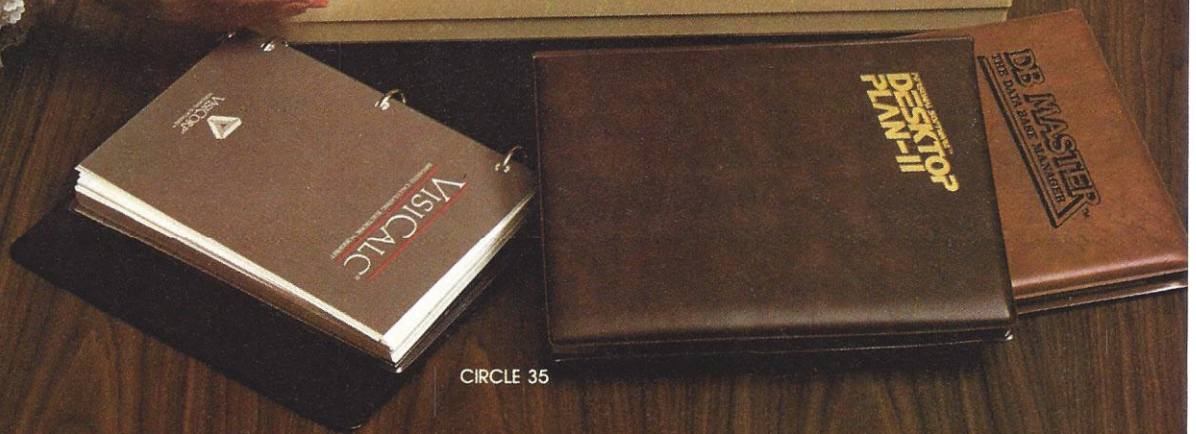
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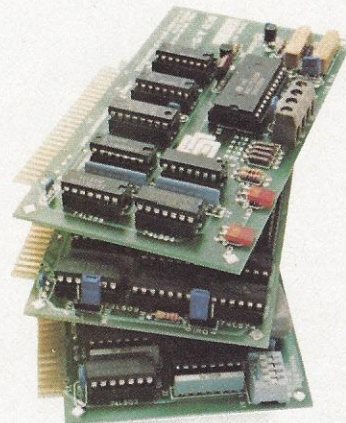
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OUTLOOK

rities, real estate, food distribution and other industries. Ironically, it has not been applied in the technology-intensive industries," Pinsky adds. "It's a new idea, and people—the marketplace, so to speak—are taking hold of it and helping to shape it. It just has that kind of appeal."

For more information on Connexions, contact Professional Data Corp., 55 Wheeler St., Cambridge, MA 02138; (617)492-1690.

WELCOME TO COLLEGE—HERE'S YOUR COMPUTER

One thousand freshmen entering Clarkson College of Technology in Potsdam, N.Y., next fall will be issued Zenith personal computers during their orientation. The college is redesigning every aspect of its curriculum to capitalize on the new computing power each freshman will have in his dormitory room. This computing-literacy effort will continue until every one of Clarkson's 3800 undergraduates has his own personal computer. When each student graduates, he will be able to take the computer home or to a first job.

"The computer is clearly the same kind of tool now that the slide rule and calculator have been in the recent past," says Robert A. Plane, president of the 86-year-old private college in upstate New York. "Our goal has always been to provide our young people with the skills, knowledge and cultural openness that are important for their total development. Our trustees decided two years ago that we should integrate personal computing into every aspect of education at Clarkson."

"It was immediately evident that the computer we selected should have the broadest possible base of available software," says Plane. "We know our students and faculty will develop a large number of special uses for these computers, and they will want to have a large library of programs and languages from which to choose."

The selection of the Zenith personal computer was an academic decision that resulted from research done by a faculty committee. "The committee decided that the computer we would select should use a microprocessor from Intel Corporation's 8085 8-bit and 8086/8088 family of 16-bit devices," Plane says. "The Zenith Data Systems' Z-100 personal computer uses both an 8085 and 8088, which allows it to run either 8-bit or 16-bit computer programs."

The financial ramifications of the decision were studied by William A. Dempsey, Clarkson's vice president. The retail value of each machine and its software is in excess of \$5000. The cost will be subsidized by restricted college grants so that students will pay only \$200 per semester and a one-time \$200 maintenance deposit fee. At the end of four years the computer's title passes to the student.

The Z-100 has 128k of user memory, a floppy disk

drive with 320k of storage, a high-resolution monitor (CRT) and two separate operating systems. For the 8-bit programs, it uses the CP/M operating system from Digital Research in Pacific Grove, Calif.; and for 16-bit applications, it uses Z-DOS, a derivative of MS-DOS from Microsoft in Bellevue, Wash.

Languages available on the students' Z-100s will include FORTRAN, Z-BASIC and Pascal. Each student will be supplied with Multiplan, a spreadsheet software program, from Microsoft, for financial analysis. Clarkson is currently in the process of selecting a word-processing program for the students' computers.

David Bray, professor of electrical and computer engineering, was named to a new post, dean of educational computing systems, to oversee the application of the personal computer to all phases of the Clarkson curriculum.

While the school is searching for an appropriate word-processing program, says Bray, "we will use a home-grown word-processing program generated here at Clarkson, which we call Galahad. It is published by our campus group, 'Golden Knights Software.'"

Intel Corp. of Santa Clara, Calif., will donate a complete set of training materials to the college. Several units in the computer-science curriculum will be devoted to the study of the internal architecture of the Intel 8086 and subsequent 16-bit, single-chip personal computers.

Clarkson officials plan to study the various schemes for networking the student computers with each other and with the college's central computer, an IBM 4341 Mod II.

"I am convinced that Carl Sagan is correct in predicting that the next development in human intelligence will be a partnership between intelligent humans and intelligent machines," says Plane. "That intellectual development will begin here, at the college level, when Clarkson courses, in all disciplines, are aided by student use of the personal computer."

AUTO DEALER KEEPS HIS BUSINESS ON THE ROAD TO SUCCESS

A Boston car dealer, with the help of an Altos personal computer, has reduced parts inventory, raised gross profits on total sales and improved product turnover for a net cash gain per year of over \$50,000. According to A. Harlow Ellis, president of Gaston Andrey, the ASC8000 computer has more than paid for itself in inventory control alone. "Our order and receiving programs, general ledger, accounts payable and accounts receivable will be on the computer shortly," he says.

Gaston Andrey opened for business 25 years ago and is now one of the largest SAAB dealers in the country. Almost 300 new SAABs and Alfa Romeos are sold per year, representing over \$3.5 million annually. Gaston Andrey also services its sales and is therefore required to

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keep a sizable parts inventory on hand. Approximately 700 to 900 parts, valued at \$12,000 to \$15,000, move through the service department each week.

"Accuracy in sales turnover and sales-projection data is critical to our inventory control," Ellis says. "Because we deal in high-volume sales, some items are out the door almost as quickly as they come in, while others may sit on the shelf for some time. We needed to make sure that we didn't have too many dollars tied up in inventory that



An Altos personal computer is the core of a system that enabled A. Harlow Ellis to achieve a total net cash gain of \$50,000.

wasn't moving. When you have dollars sitting on a shelf, you automatically have cash-flow problems."

The company's original inventory system was handled by an independent service bureau. Unfortunately, several problems surfaced, the main one being the lack of timely data. According to Ellis, parts are ordered weekly and the inventory reports from the service bureau came out bi-monthly. By the time the information was received, the figures on the reports did not match the amount of stock Ellis had on hand.

"Because we were basing our orders on a stock situation two weeks old, we would often find ourselves either overstocked or facing a shortage," says Ellis. "It was simply too expensive. We had to change."

For several years the company had been looking for an in-house computer system with little success. Some per-

sonal computers didn't have the computing power the company required, and minicomputer systems were too expensive for his small business.

Ellis decided to contact Jesse Torres, president of Corporate Computer Systems. "I suggested the Altos ACS8000 because I knew it could do the job," says Torres. A former owner of his own car dealership, Torres has also developed a special software package called The Boss to meet the needs of the auto industry. The software features service invoicing, inventory, point-of-sale, labor tracking and all general-ledger applications.

The system installed at Gaston Andrey consists of an Altos ASC8000 computer with a 10-inch Winchester hard disk, which assures sufficient storage, and a tape drive for backup. Data are accessed via three Soroc terminals, and a Centronics 702 printer provides hard-copy reports.

"One of the nicest things about our Altos system is its modular capability," says Ellis. "We are currently running our parts-inventory, order and receiving applications. We will soon have our accounting and car inventory on the system. There is a lot of room to grow, and we can add as many as four terminals to our system."

The parts-inventory application consists of two primary files. The main file contains total information on 4500 parts, including quantity, wholesale and retail price, numbers required to maintain stock and back-order status. It also indicates whether a part is seasonal (such as snow tires), and if so, during which months it is most likely to be required.

The inventory process begins with a daily report from the computer indicating inventory status for each part. If the quantity falls below the required amount indicated by the computer, a menu-driven program is used to place an order. Basically, the computer asks for data, such as the part number, the quantity to be ordered and the vendor, which a clerk enters into the system. Once all of the data are obtained, the order is automatically printed out.

Both repair orders and over-the-counter sales are entered into the computer on a daily basis. In the case of counter sales, the salesman enters the customer's name, the part purchased, the quantity, the part number and the cost. The computer simultaneously subtracts that part from inventory and prints out a hard-copy invoice for the customer. The standard repair orders are entered at the end of each day.

A number of management reports are generated to help streamline the company's operations. The parts and service audit trail lists the amount of sales, including tax, by invoice number. The transaction report is a quantitative analysis by manufacturer—SAAB or Alfa Romeo. It also provides warranty information that allows certain parts to be charged back to the manufacturer. A daily warranty report tells which parts have actually been returned.

The Spelling Bee Is Over

Listen. We're going to let you in on an industry secret: It's not hard to make a good spelling checker.

You see, although spelling checking is new for microcomputers, it's been around on big computers for years. And when you get past all the talk, most spelling checkers work the same way. They compare what you've written with a dictionary—and report the errors.

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Who Checks The Checker?

The hardest part of a spelling checker to make is the dictionary. It's hard to pick the right words—and spell every one of them perfectly. That's why some popular spelling checkers don't even contain real dictionaries. They use formulas called "hash tables." Which make a hash out of your spelling some of the time.

Other spelling checkers "borrow" their words from printed dictionaries—or copy them from old word lists. Or give a programmer who can't spell "programmer" a chance to write his first dictionary. And as though all this wasn't bad enough, a lot of these

companies want to charge you \$100, or \$200 or even \$300!

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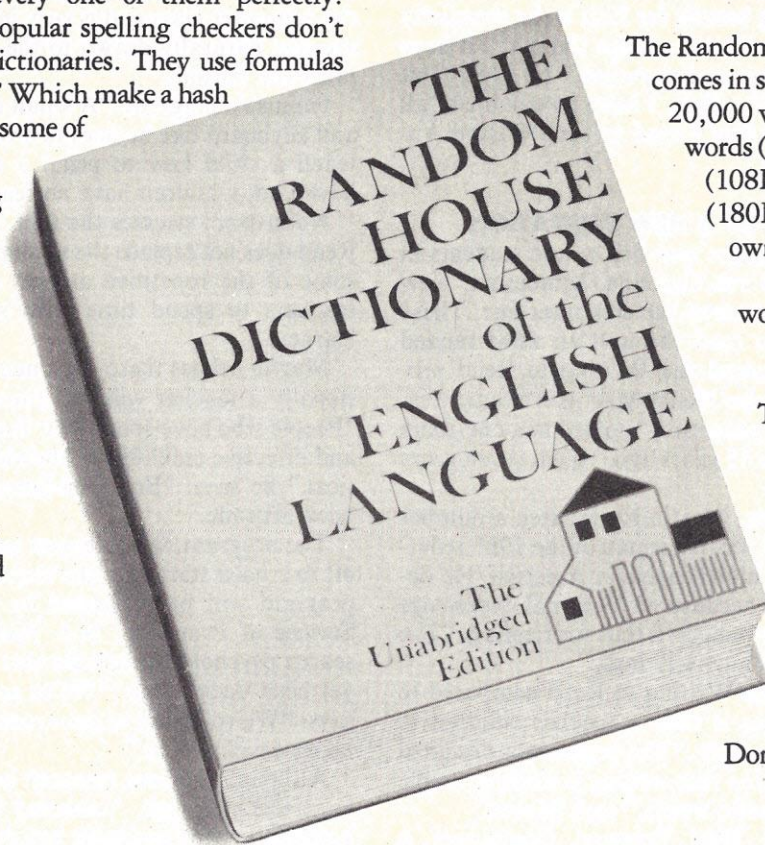
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CIRCLE 12

An inventory-parts sales report provides total sales for the day and is compared to the actual cash taken in. A final report lists work in progress, or those jobs that cannot be completed in one day. "When everything is added up, we have much better control over our sales and inventory data, and we save money," says Ellis.

Gaston Andrey can expect even more cost-effective returns in the future. A car-inventory system, which will work in much the same manner as the parts inventory, is scheduled to go on line shortly, as will an accounting system. Eventually it will also be possible to calculate salesmen's commissions and other sales features.

Perhaps the overriding benefit for Ellis is the simplicity of the computer system. "I had always thought I'd have stage fright when it came to computers," he says. "But between the Altos and The Boss, I have no trouble at all in obtaining the information I need to keep Gaston Andrey in cherry condition."

THROUGH THE DOOR OF A NEW EDUCATION

Ten thousand kindergarten and first-grade students in California, Texas, North Carolina, Minnesota, New York and Florida have entered the computer age. These children are learning to read through an IBM-funded experiment revolving around the Writing to Read program developed by Dr. John Henry Martin of Stuart, Fla. Martin, whose career in education "started in a one-room schoolhouse in Alabama 45 years ago," spent seven years developing the program.

A well-known educator, Martin has written a number of books and articles and was chairman of the 1967 federal government study on high schools in America. He designed Writing to Read because his personal experience in teaching and research indicated that for reading, "The failure rate in schools is intensely high."

The difference between Writing to Read compared to most teaching techniques is that it teaches children to write and read simultaneously. "The program is designed to communicate to children that writing is making visible the sounds you use to make words," says Martin.

Each of the loaned IBM Personal Computers is equipped with 96k of RAM, a color monitor, graphics and a voice digitizer from Mountain Computer of Scotts Valley, Calif.

Martin stresses the importance of the voice synthesizer. "We would never hire a mute teacher," he says, "yet we're buying thousands of computers that are mute," and expecting them to teach. "If you program the computer in a way that is interactive with the user, the computer will tailor itself to the child sitting in front of it."

Writing to Read uses games and exercises to reinforce learning. In one exercise the computer pronounces the name of an object displayed on the screen along with the spelling. One spelling game requires the child to spell

"m-o-u-s-e" before a cat gobbles the animal for lunch. Another game is described by Martin as "silly sentences." "We'll put a picture of a pig in a bed on the screen," says Martin, "or a sentence like 'A fat cat with a hat wants to catch a mouse in his house.'"

Parents seem to be responding with enthusiasm to Martin's program. Larry Holmstrom, manager of ES Learning Systems for IBM, admits that some parents have transferred their children to different schools so that they could participate in Writing to Read.

Erin Fenniman of Stuart, Fla., says her five-year-old son Erik loves Martin's course. "He doesn't want to miss the computer class and is very highly motivated. The kids are just naturally drawn to the computer. They want to press the buttons."

Holmstrom agrees. "A small child takes to a computer and keyboard like he does to a tricycle. You don't have to teach a child how to pedal a tricycle or how to use a keyboard. Children have no fear of the computer."

Holmstrom stresses the fact, however, that Writing to Read does not replace the teacher. Instead, it "takes away some of the repetitive aspects of teaching. This allows teachers to spend time with students who are slower learners."

Martin echoes these sentiments, but he feels that occasionally a teacher will feel threatened by the computer. "People who have spent their lives with tender loving care and effective teaching of knowledge are sometimes skeptical," he says. "But sometimes healthy skepticism is a good attitude."

The program, which began last November, seems to be off to a good start. Yet the real test lies ahead. The entire program will be evaluated by the Educational Testing Service of Princeton, N.J. Richard Murphy, senior research psychologist, admits that testing methods have not yet been decided on. "We're sort of just beginning," he says. "We're trying to get around and see the schools it's being developed in."

Although previous research has validated the computer as a teaching tool, "outcome and validation measures have never been available before," says Martin. "Now we are testing applicability, and this is something people have a right to ask for."

Perhaps what will make Martin's program successful is that it employs children's maximum use of sensory input. Through Writing to Read, hearing, sight and touch are all aspects of the learning process—along with continual feedback and the opportunity to progress at one's own pace.

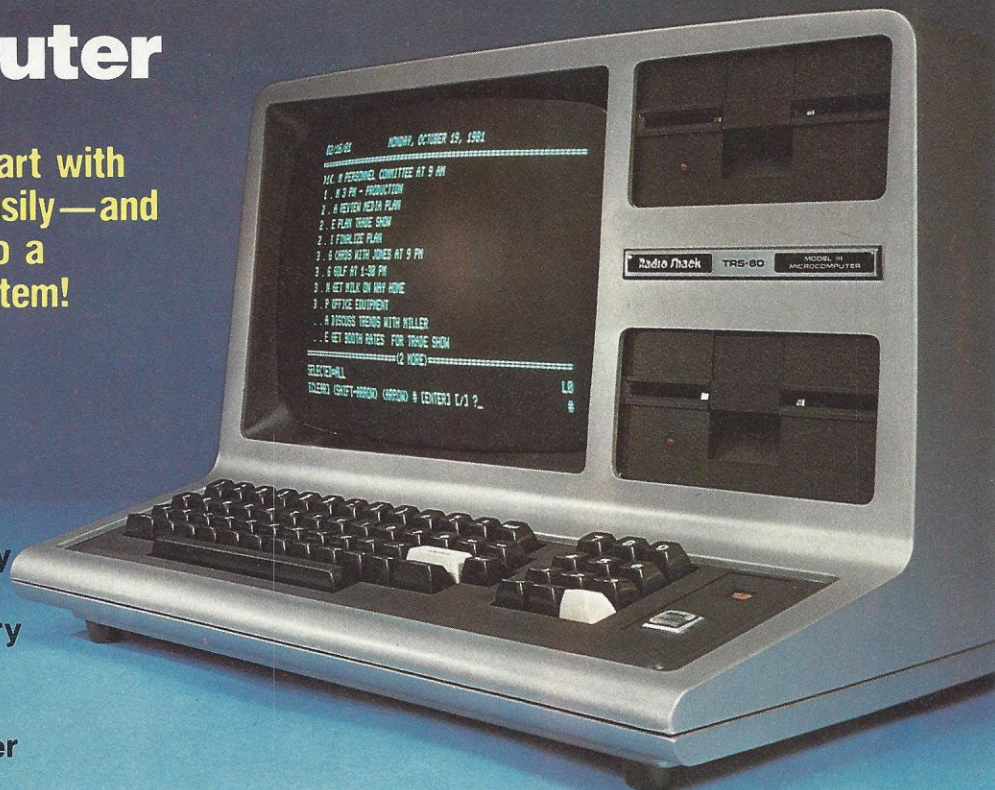
"The computer invites children to think," says Martin. "I believe children are going to be brighter and better educated than ever before."

And does Martin feel we are entering into a new age of
(continued on page 37)

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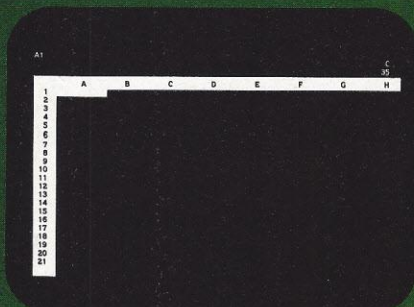
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CIRCLE 13

VISICALC*



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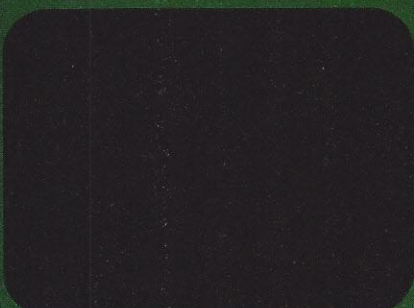
ON-LINE REFERENCE GUIDE

NO



"NAMING" OF CELLS
OR AREAS

NO



PLAIN ENGLISH PROMPTS

NO



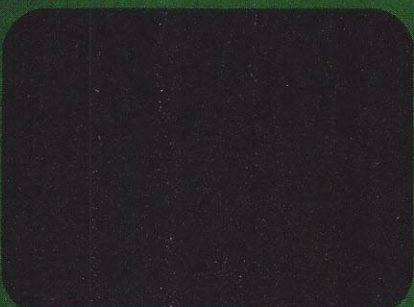
INDIVIDUAL COLUMN
WIDTHS

NO



EXTENSIVE FORMATTING
CAPABILITIES

NO



PROTECTED CELLS

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NO



SORTING CAPABILITY

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*Based on features in releases VC-202B0-AP2 and VC-156Y0-IBM of VisiCalc on the Apple II and IBM-PC respectively.

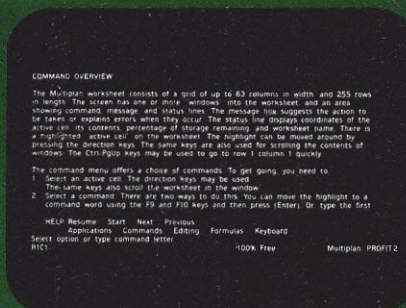
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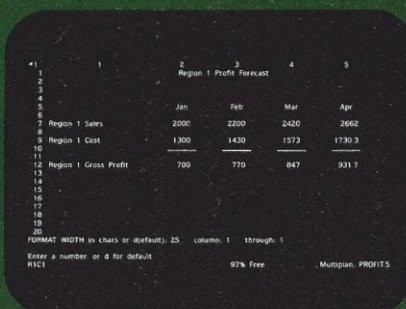


"NAMING" OF CELLS
OR AREAS



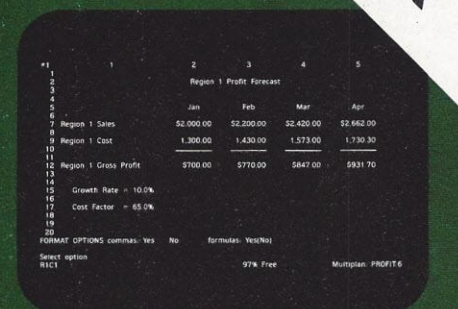
PLAIN ENGLISH PROMPTS

YES



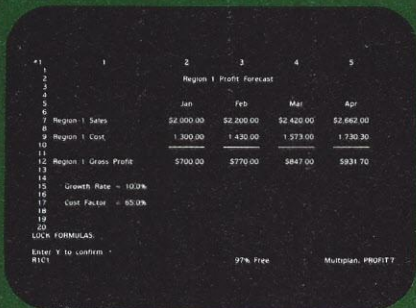
INDIVIDUAL COLUMN
WIDTHS

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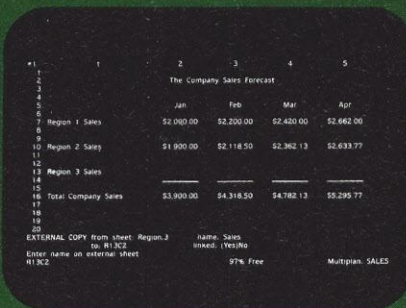
EXTENSIVE FORMATTING
CAPABILITIES

YES



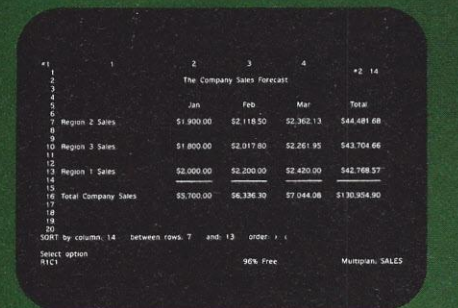
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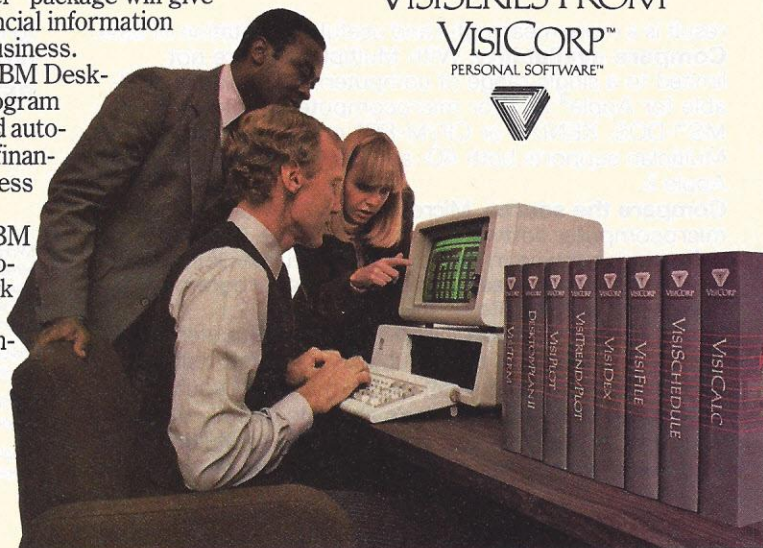
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THE IBM
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(continued from page 32)

education? "I don't think we're entering, I think we're through the door."

EXPAND BUSINESS OPPORTUNITIES BY ADDING MORE MEMORY TO YOUR PERSONAL COMPUTER

Adding more memory to your personal computer offers speed, convenience, and best of all, it saves you time. You could use this time-saving feature to work shorter hours, but not many people do. Most personal-computer users take advantage of the extra time they get by adding more memory to tackle new projects. You can get involved in new and exciting tasks, such as large-scale business opportunities, or even restructure the way you work.

Frank Arford and Chuck Palanca, partners at Crowe, Chizek and Company of South Bend, Ind., a CPA firm that offers consulting services to financial institutions, have done both. They have used the extra memory they added to their Apple II Plus personal computer to expand their business opportunities, and they have restructured the way they work by doing projects on the personal computer that the company's data-processing department used to do on its minicomputer. By adding a Saturn Systems 128k RAM card, which brings their Apple II Plus' memory capacity up to 176k, they can now offer large-business financial practices to their medium-size banking clients.

Crowe, Chizek's data-processing department consists of a DEC PDP-11 minicomputer on which Arford and Palanca developed a 350k financial profit-planning model with the aid of a financial-modeling language program they leased. But it would have been necessary for their clients to buy a minicomputer in order to take advantage of the profit-planning model. Since most small financial institutions can't afford this kind of investment for just one application, Arford and Palanca adapted the program they developed for the minicomputer to the Apple II Plus personal computer.

Even that step was not easy, though. Although they could break the model into smaller parts using VisiCalc (the spreadsheet program from VisiCorp of San Jose, Calif.), the project became unwieldy and they found that they needed more memory. When they added the Saturn Systems 128k RAM card to the Apple II Plus and got 176k of RAM, they found they could run the program in two or three pieces, each occupying the 145k user space they get after loading the initial program. At that size, Arford reports, he's using the system to its fullest capacity, using all of the rows, columns and calculation formulas VisiCalc offers.

The next problem that Arford and Palanca had to tackle was selling their conservative clients on using the Apple computer for regional bank profit planning. "At

first the clients couldn't believe that it was a totally contained computer system," notes Arford. Most of the bankers didn't believe that the small computer was doing the functions they saw all by itself. They were sure that such a system would have to cost a lot more than the Apple does and have a lot more limitations.


Arford and Palanca have used the time-saving conveniences of more memory to save themselves the inconveniences of more work. And they have ended a long-felt struggle to communicate their business intentions to people whose expertise rests with data-processing functions. "It's practically impossible to relate some of my consulting problems to someone who knows computers but who knows nothing about my business," says Arford. "I can solve these problems just as effectively myself, with the expanded Apple and VisiCalc, as a DP programmer."

STUDY FINDS BIG MARKET FOR HOME DATA SERVICES

A two-year experiment by *The Associated Press* and 11 of its member newspapers, including the *San Francisco Examiner*, has shown that there is a large potential market for electronic home-information services such as CompuServe, Dow Jones and The Source. But the market is still highly specialized, and more work must be done to improve the delivery and marketing of the information to make it easier to use.

A report by RMH Research Inc. of Fair Lawn, N.J., looked at several aspects of the experiment started in July 1980 by *The Associated Press* in conjunction with CompuServe. Among the findings were: "About one out of six consumers nationwide is a serious and current prospect for a service like CompuServe." And the potential market is greatest among young males of high income with above-average experience in computers, often as a result of their jobs.

The test was designed, in part, to explore the potential for the electronic delivery of newspapers to the home and the impact such delivery would have on conventional readership habits. It found that in current form, services like CompuServe do not seem to affect newspaper readership or radio use. The services do, however, cause a decrease in television viewing.

The research firm found that while CompuServe subscribers generally remain different from the population as a whole, there are signs that acceptance is becoming more widespread and that more recent subscribers tend to differ from early customers. "More recent subscribers are more likely to be female (though most subscribers are still male). They are slightly younger, more likely to have children who use the service, and are slightly less upscale in terms of household income. They are also in occupations that are less technical." 

Dan Fylstra On Present And Future Computer Users

Dan Fylstra is one of the pioneers in the personal-computing world. But unlike other pioneers Personal Computing has interviewed, many of whom got in on the ground floor in the hardware business, Fylstra got started with software.

That obviously was the right choice for him, because the software product that got his company going was VisiCalc, which has been credited with selling more personal computers than any other single thing—or person.

VisiCorp, or Personal Software as his company was then called, continues to be a dominant force in the world of personal computing. Since Fylstra clearly plans that his company maintain such a dominant position, he has put a lot of thought into the present and future needs of personal-computer users.

Why don't you start by telling me a little bit about yourself. Where did you come from and how did you get here?

Fylstra: I have a graduate degree in computer science from MIT and an MBA from Harvard. And it's a well-known story that VisiCorp was started right out of business school. Before that, I had been involved in the start-up of *Byte* magazine as an associate editor. I was also involved very briefly at the start of *Computer Dealer*. And I worked since high school as a systems programmer.

What gave you the idea for VisiCorp?

Fylstra: VisiCorp was really started with the idea that it was a golden opportunity. It was right about the time that the Apple II, the TRS-80 Model I and the Commodore PET were introduced, and I felt that those were the first computers that had an opportunity to sell software in

big quantities as standard packages. *You saw these machines developing a market?*

Fylstra: Right. And what we ran up against very quickly was that there was no effective way to reach that market. There were all sorts of people writing programs, but there was no real contact in the market. There was really no way to find out what was needed to get in touch with the market and the emerging customer base. There was no way to distribute or deliver the product. We stepped into

“What's required in the software business goes well beyond just writing programs.”



that void. We built a marketing and distribution system for our own purposes, and along the way we actually began—we bootstrapped our way up—by acquiring and marketing other people's software. We also produced our own software in the early days, and we have gradually extended that capability. Our view of what's required in the software business goes well beyond just writing programs.

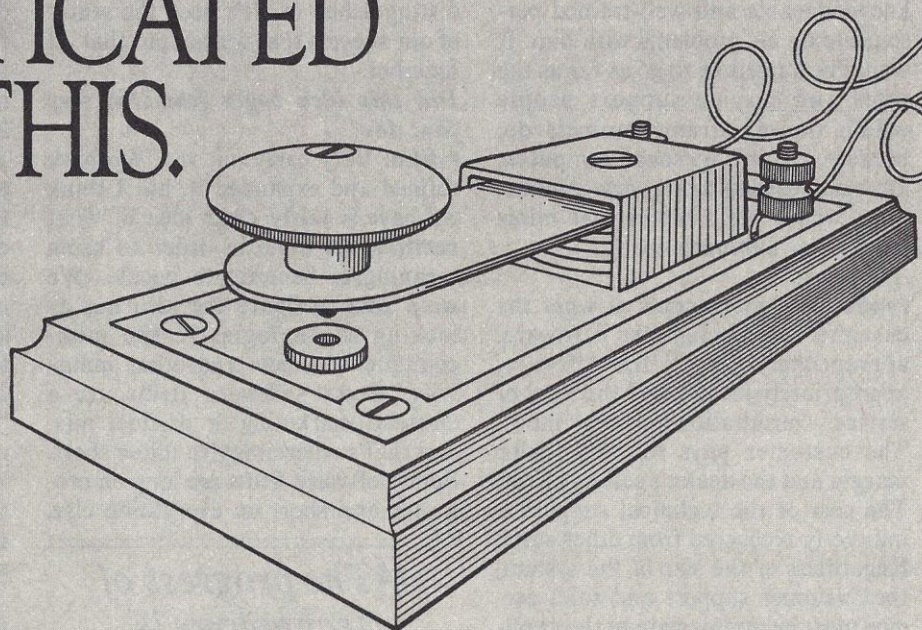
What do you think is required for a successful software business?

Fylstra: If you look at all the successful software firms in all parts of the computer industry—go back to minis and mainframes and so on—most firms are writing lots of programs. But the really successful software vendors have put together a full-range service capability for their customer base. First of all, they understand what their customer base is. They have people writing software who direct it at the customers and their needs. And successful vendors who understand what those needs are and aim their efforts at some of those needs can solve some well-defined sets of applications.

What role do you feel the dealer has?

Fylstra: Each group of people needs aids in order to effectively use a computer. People need hardware, software, manuals and instructional materials, technical support and trained salespeople up front who can essentially act as consultative problem solvers for them. That's the role we feel the dealers can and will claim for our products. A person who has never been exposed to a computer before and who is thinking about buying one, a person who might have a use for one, really isn't sure how you put one of these things to work. That person needs to be able to walk into a

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retail computer store, describe a problem and have a reasonably knowledgeable and well-trained person discuss his problems with him. It would be a mistake to go as far as the sales and service support people within the mainframe business do, because I think personal computers are being used in totally new applications where mainframes and minis were never appropriate.

And price?

Fylstra: The components of what the customer buys include the hardware, appropriately priced; the software, appropriately priced; and the level of service, consultation and sales input. The customer pays for the dealer margin and the dealer's selling effort. The cost of the technical support is indirectly recovered from other costs. Regardless of the size of the system, the customer support and sales service must be appropriate to the application. Otherwise you suddenly would have to pay \$3000, \$4000 or \$5000 for the computer—the hardware and software—and another \$5000 or \$10,000 for consultation and support service. Then the whole product would not be appropriate for a lot of applications.

What is VisiCorp doing to keep costs down and meet customers' needs?

Fylstra: Part of what we are doing is designing an appropriate level of total product mix, which includes putting our products on the right hardware, providing the software, making sure that it is thoroughly tested and quality assured, and providing good documentation and technical support. Then we train with dealers face to face, out in the field, so they are knowledgeable enough to apply our software products to people's problems to try to solve those problems. And then we have an ongoing program of maintenance and improvements, continuous reinvestment in improvement of the software and all the particulars as well. You need to put those things together in order to really meet the needs of

the customers. And I think—more than any one thing—that's what has distinguished us. It's been the secret of our success that we can put that all together.

Did this idea begin from the very first day?

Fylstra: Very early on, yes. We have refined and expanded it, but I think we have a fairly clear idea of what needs to be done in order to bring meaningful benefits to people. We were able to figure the idea out by looking at analogies in the mini-computer business and other industries. Some software firms use a classical marketing or product mix, and that's where they've fallen short. Some software firms are long on programs and short on everything else.

“The progress of technology is inexorable. We must develop for the best of what's new.”



And that's to our benefit. We've followed our own practice, and it has distinguished us in our philosophy from a lot of other software vendors. A lot of software vendors say, “We'll make our software available on all 300 or 600 different computers.”

All CP/M machines in the world?

Fylstra: Yes. And they say they'll do that by offering license and source codes to the various hardware vendors. The software houses will leave it up to hardware vendors to make the software work on specific computers that they sell. Or sometimes software houses will deliver a product that will “run under CP/M,” but then the manual from the software vendor is kind of general and doesn't really describe the steps the user must go through to use the program on his specific machine.

But we have taken the approach that we are responsible for meeting the end-user's needs, solving his problems completely, from the time he first opens the box. He has to plug in the power cord and insert the disk the right way—not upside down or backward—and learn his keyboard. I've seen so many people who have trouble using their keyboards for the first time, and these people should not have to cope with a manual that describes something that is different from their machines or from their versions of the software, or deal with a piece of software that has to be configured or changed in some way to run on their machines. You can't expect first-time users to cope with that.

That's led us to put our software on only a small, select number of machines. Part of our problem has been to pick the machines that are appropriate and offer the best combination of features for our customers. The other main issue with software is that you just can't aim a shotgun at everybody. You can't do a good job meeting one group's needs if you try to simultaneously address the whole market—the science and engineering

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INTERVIEW

market, the business/accounting market, the productivity tools market and so on.

You can please some of the people some of the time?

Fylstra: Right. It's best to pick your own customer base and do the best job you can for those customers. In our case, we have taken the machines that we feel have the best combination of features for the personal-computer users interested in personal productivity. Primarily we have emphasized the Apple, the TRS-80 and now the IBM, which are the most widely used machines.

But aren't those machines also in the home in fairly big numbers?

Fylstra: Clearly. Now you'll find machines like the Commodore VIC 20, the Atari 400 and the Radio Shack Color Computer being used in the home.

Because they are part of a lower-priced alternative?

Fylstra: Yes. And the home market is only now beginning to open up with the kinds of products that are appropriately sized for that market. I think, by and large, you'll find that they are used in a number of markets. But I find the largest single group of personal computers is used in tools applications.

How does this affect the industry and VisiCorp?

Fylstra: The Apple II and the TRS-80 Model III and so on are relatively mature machines, so they've got every imaginable kind of peripheral, a wide range of software packages available as well as a lot of awareness and lots of books written about them. But in the meantime, technology has been moving ahead, and I think we are entering a period of transition in which there is tension in the marketplace between the mature machines that have all of these capabilities—all the software and peripherals and so on—and the newer machines that take advantage of the new technology—16-bit processors, larger memories, larger capacity disk

drives, greater speed and so on. The progress of technology is inexorable, and sooner or later the new machines will come to the fore. Our job, then, is to pick the best and most appropriate machines for certain applications and do the best possible job on those machines.

Is the 16-bit Apple one of the machines you're talking about?

Fylstra: I can't comment on future computers, whatever they may be. Talk to me later. The IBM is the first kind of machine. It does have the capacity for larger memory, and it's got a more powerful processor in it. The company has just announced high-density disk drives, and the machine has higher resolution graphics. We had a chance to to work on the com-

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puter almost two years ago. And that's very helpful, because the development times, the lead times for producing significant software application packages for a new machine—and doing a really good job on that particular machine—are quite long. For the past year and a half, we have been devoting a large and increasing fraction of our efforts to software packages, naturally integrated systems and individual applications that take advantage of the capability of the new machine.

Of that one particular new machine?

Fylstra: No, of a class of machines of which the IBM is one example. The DEC professional machine is another example, and there are quite a few others, some of them not yet announced. But we define a class of machine—independent of any one machine—and we lay down a set of instructions for ourselves about the machine: what capacity the processor has, how much memory it has, what kind of graphics are included and what we can do to really exploit those capabilities. And then we find the most appropriate machines that fit in that class and develop our software for those machines. Two that have been announced are for Atari, and obviously we are active with the IBM and DEC machines, and there are others.

I guess the bottom line is that the new machines are going to have 16-bit processors, lots more memory, use of graphics and larger disks. So what does that mean for the user?

Fylstra: It doesn't mean anything until there is application software that takes advantage of it. We've been working on that. I think you can expect several kinds of things. The main thing that is happening here is that we're seeing more functionality and greater performance capacity. But more important, what we are finding is that if you look at the kinds of applications that are most valuable to first-time users, a lot of the software design and programming is

INTERVIEW

making the human interface more approachable the first time—easier and more fluent to use on an ongoing basis, more interactive and responsive, with computations in the background of the application. You can see that in almost every one of our products.

For instance, VisiPlot does all the scaling and point-to-point computations for the graphs and plots and will do transformations and statistics and so on. A lot of the development effort is devoted to presenting nice graphs on the screen and making it very quick and easy to prepare those graphs. In 30 seconds, you can put up a graph and start defining it. VisiCalc is also that way. It basically does operations like addition, subtraction, multiplication, division, putting in present values and sums, and that sort of thing. A large part of the effort in designing VisiCalc has gone into making a lot of computation capability very accessible to people, and very approachable. Do you know the metaphor about the spreadsheet? The spreadsheet is the piece of paper, the cursor is the pencil and the calculator is built in. Well, we've put a lot of effort into software design that aims at that metaphor. Now, with the capacity of new machines, we are going to go much further in that domain to make things more familiar and more easily used.

Will you be doing anything else?

Fylstra: There is something else that we can do that is related. People's problems usually span several application areas. To begin with, they might want to do a sales forecast using VisiCalc as a spreadsheet package. But the problem can quickly become more than cranking up the numbers for the sales forecast; the problem might become something like getting some data on which to base a sales forecast, which the user might appropriately maintain in a data-management system from VisiCorp.

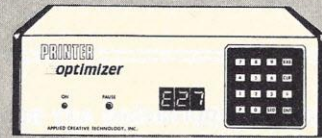
You mean, they find something else they can do with a personal computer?

Fylstra: Yes. But all these things are interrelated. The full problem clearly involves the task at hand—getting the data for the sales forecast, in other words the projections in the forecast—and then presenting the information. This usually means doing graphs or plots or printing reports or whatever, because that's part of the job. And then perhaps it involves performing other functions, like transmitting those numbers over the phone line to a higher-level manager or to another group that needs the numbers. So, increasingly, people really need to use what are now individual applications in combination with each other. Right now people have to do one function and then trade some disk files to do another. With our product, you can exchange data and run another application and reboot the machine with a new application. With more memory and more screen capabilities and so on, you can bring that all together and make it very convenient and fluent to solve those kinds of problems by performing applications concurrently. And you can move fluently from one to another. The real imaginative challenge for us as software designers is to look at the potential to do that and to say, "Now what can we really do to it, what metaphors can we use, to make these capabilities approachable and familiar to people who haven't touched a computer before but who know how they have done these functions manually in the past?" So a lot of design and software development efforts are going into new metaphors.

I never heard of programs referred to as metaphors before. That's interesting.

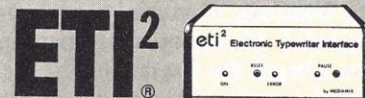
Fylstra: Yes. I've often pointed out that an application package does two things: It directs the hardware in a sense and performs functions, but it also organizes the application for the user in many ways. It takes a problem

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INTERVIEW

that can be approached any number of ways, gets it organized and presents it on the screen. It has to organize and present things to guide the user through a task. So the introduction has to be the bigger part of the job.

Is the most successful program the one that does the best job of presenting the problem?

Fylstra: Very often, yes. It's probably the key distinguishing feature of VisiCalc, for instance, and it's a key factor in each of our products. I can give you several examples. Let's start with VisiCalc. Financial modeling—financial planning systems—has been around for years. But to use a financial model in the past, you literally had to be a programmer or a very sophisticated computer user, because you had all sorts of cryptic commands. You would prepare a big command file, ship it off and run it. It would crank out, and the numbers would come back at you. You had to understand notions about variables and sequences of commands and so on. VisiCalc performs a lot of the same kinds of analyses and computations in the background, but it was all made very approachable by presenting a familiar notion of a spreadsheet.

Another example is VisiFile. There have been data-management—database—systems for years. In the large mainframe world, it takes a very sophisticated systems programmer to install a data-base system. It literally takes legions of systems programmers to install these things and design the data. And one of the big undertakings is to design what those data are going to represent in this system—how records and fields are going to be laid out, the relationships between them and so on. We must provide a way for the first-time user who has never touched a computer before to do that.

So you provide a metaphor for a filing cabinet?

Fylstra: In this case, a successful

metaphor is really a form on a screen. And VisiFile is all oriented around forms on the screen. It's done this way because when people have files on paper, the files are usually organized in forms. With relatively structured files like those that keep track of, say, names and addresses of customers and outstanding balances due, there are card files that have the information all laid out. It is a very familiar notion. We have a demo that is used for someone to set up a problem and define the data that are going to be handled. Let's say the file is going to have names and addresses and so forth. The person can enter some data on the screen in a forms-entry mode and then print a report. Then the user has a general way to

“The challenge to software designers is to find the metaphor that helps the first-time user.”

review it and show it all in five minutes. In a relatively short time—30 minutes to a couple of hours—the user can start solving his application. With all three kinds, we've paid a lot of attention to things like menus, help messages, error recovering and that sort of thing, but we also present things in a familiar and approachable kind of a way. And what you see in our current products is what we can do on existing machines and what we originally were doing several years back. What you'll see on the newer, more powerful machines is substantially better.

So you have been working now for about two years on machines you're projecting about?

Fylstra: Yes, but we are designers in the very unusual position of having an advanced look at hardware.


What happens, though, if XYZ Corp. comes out with the super-whiz-bang of them all that you don't know about?

Fylstra: If XYZ Corp. is going to be a major factor in the industry, or if it intends to be, it would probably have come to us already. And if it hasn't come to us, done similar things with others or, in a sense, done its homework, then its chances of success aren't great. You know, there is an analogy here. People can design the most wonderful whiz-bang hardware, but if it is the greatest cost-performance, raw iron you have ever seen, it won't help customers solve any problems until the whole set of needs has been addressed—appropriate systems software, appropriate applications, user manuals, dealer training and the whole works. How many people do you think will be able to use this whiz-bang, ultra-high-cost performance iron?

Only programmers?

Fylstra: Sometimes. Even majors, even the billion-dollar players in this business right now find their resources consumed with their existing businesses, getting designs out the door, getting systems software done or whatever it might be. And by the time they're finished, they're ready for the next generation machine. It's a never-ending process. And that's why hardware vendors, even the very large ones that have thousands and thousands of programmers on staff, have turned to independent vendors.

For specific applications? In other words, they will develop something like the main operating system and a few general applications, but for something like a spreadsheet, they might come to you?

Fylstra: Right. They'll come to us for special applications. The key thing that a software vendor has to do is pick an area and understand it—a customer base, a market—and develop specific applications that do the best possible job of meeting those people's needs. 

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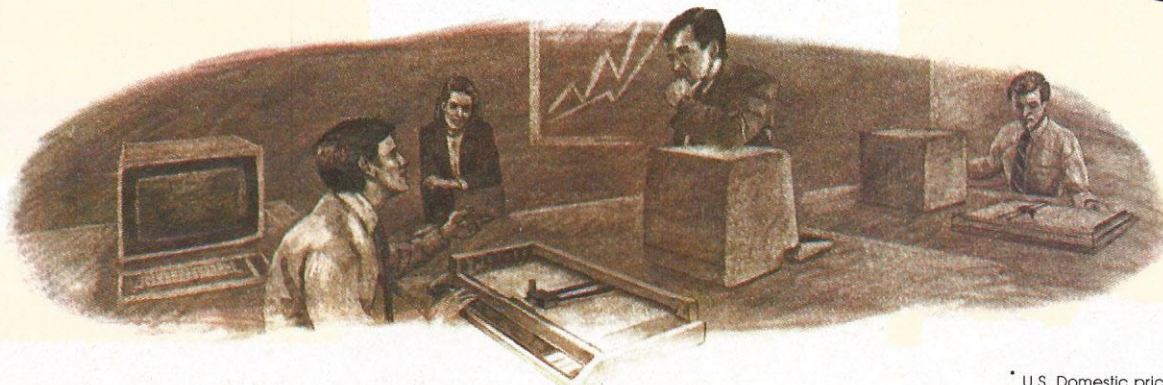
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Networking: A Powerful Tool For Personal Communication

It may be the most important trend on the horizon of personal computing. But when is a network not a network? And how do you know when you need one?

by David James

Even the term itself implies power, size, importance. And, in terms of the personal-computer industry, networks over small local areas are indeed a topic of prime importance.

The concept of a local area computer network is an impressive one.

David James, a resident of Silicon Valley, loves deep-sea diving and computers.

Imagine dozens of personal computers linked together within the confines of a large corporation, perhaps even strung across several different buildings. Put a university in place of that corporation, with computers linked between different departments in different buildings across campus—the same picture applies. No longer will an individual computer user be limited to his own data

resources and computing power; information can be quickly shared, amplified and amended at will by computer users who might otherwise have to wait for a weekly or monthly meeting to make the same exchange.

A local area network is what makes the power of personal computing for businesses and professionals seem real and practical. Managers involved in critical planning



sessions, for example, could transmit and receive crucial information instantaneously; theories can be tested, facts verified, decisions made. The computer, linked with other computers, gives great power to the individual user—in some cases, far more power than he or she would ever need. In the long view, a local area network should allow the free exchange of information as well—sharing files, electronic mail and teleconferencing. The personal computer may also have the ability to communicate directly with a mainframe. Ultimately, the network itself may be able to communicate with another network.

Local area networks could also represent a major turning point in the evolution of personal computing. Depending on the needs of the users, such networks offer two paths: either a return to the institutionalized computing of the past, in which personal computers are reined in under a centralized overseer; or a chance to truly augment their individual capabilities through pooled resources, while still

retaining the independence that is at the heart of personal computing.

At the beginning

Currently, fewer than 5 percent of all personal computers sold are connected into any type of network; estimates are that within five years, nearly 20 percent will be so arrayed. At present, the technology is new and evolving; over the next year, there will be considerable confusion as to what is available, what will work and what won't.

Two things are firm, however: Currently, networking is somewhat expensive and it is somewhat complex. Thus one needs to ask precisely why one wants a network and how it would best function.

One reason for networking personal computers is to share resources—a single hard disk, for example, or an expensive printer. As we'll see, it is already possible to implement a "network" that really doesn't do more than permit shared resources.

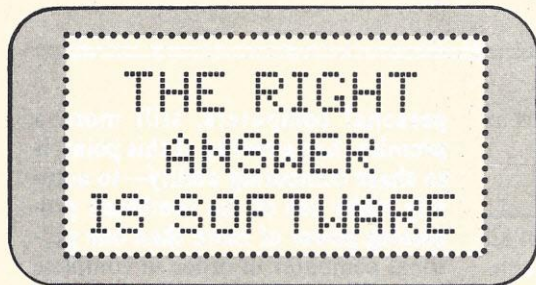
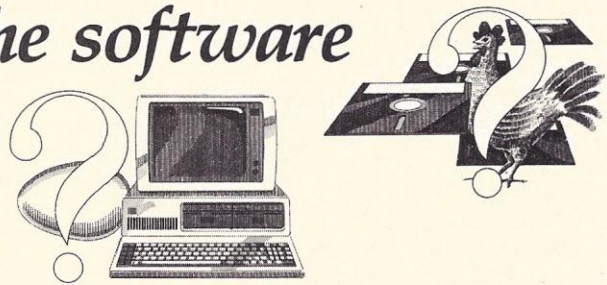
A second reason for networking

personal computers, still more a promise than a reality at this point, is to share computing ability—to actually make use of the combined processing power of more than one personal computer in order to complete complex or elaborate tasks. The ideal local area network might allow all these abilities, yet still retain the independent nature of the personal computer. In other words, the individual would sacrifice no abilities in order to be part of a network, while he is able to get all the benefits of being part of the network.

Some definitions

The current state of local area networks for personal computers is still in the early stages of rapid evolution. Both the hardware and software are in flux, although the hardware is probably ahead. "With some systems," says an observer, "it's sort of like you have a telephone. It's all hooked up, you can pick up the receiver—but at this point, you don't know how to talk."

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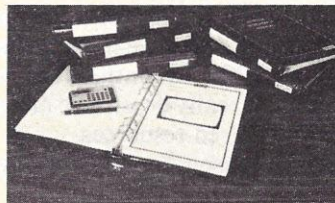
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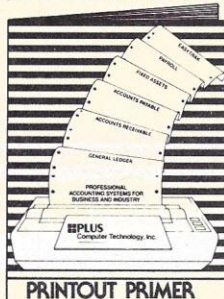


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CIRCLE 23

A local area network allows the free exchange of information—sharing files and teleconferencing.

STATE OF THE ART

True computer networks are few and far between for personal computers; what has passed for computer networks have been more traditional forms of computer linkages, in which massive mainframe computers have been joined with computer terminals to form a "distributed processing" system.

Therefore, before jumping into a discussion of the relative technological considerations of networking, it seems appropriate that some basic definitions be laid down. These definitions are important because not every computer environment *needs* a local area network to solve its needs. What is often being passed off as networking is anything but. Thus to begin:

- **Network.** This is a multiple-user, multiple-function computer system of equal units. The key here is not the multiuser configuration; indeed, a true network is less a "system" than a collection of equals. In the network, any personal computer can serve as what is termed a "remote workstation," in which the computer user simply accesses another computer for data or performs operations independent of the rest of the system; simultaneously it can also act as a central processing unit (CPU) for the entire network, with other remote workstations asking *it* for information. In a true local area network, the roles are shared. And at any given moment, a particular workstation might not even know what it is to other users—be it terminal or computer. It simply performs whatever function is required of it without the user at the keyboard being aware of the machine being remotely accessed; simultaneously, it has access to all the other members of the network without disturbing their ongoing functions. This "transparency" of the network is a crucial distinction. The key is that any computer in the network, regardless of where it is geographically, can access all the elements of the network—whether it's another com-

puter, a memory-storage unit or a printer. "Equality and fraternity" are the bywords here.

- **Distributed processing system.** It is often easy to confuse distributed processing with networking, but the two are quite different. In distributed processing the computers share nothing resembling the total equality and diffusion of computing power found in local area networks. Distributed processing has evolved from the minicomputer world—wherein a far-flung corporation might place a minicomputer at each of its regional offices and send data between those stations and the central minicomputer or mainframe at corporate headquarters. All information is exchanged under the auspices of a corporate data-processing or management-information-systems department. The linkage is between the minicomputers and the corporate headquarters only—not among dozens of remote workstations.

Distributed processing, in the corporate sense, can also mean remote computer terminals hooked up to a mainframe computer or to minicomputers. Here, the typical worker can access data on the screen of the terminal, or he can enter data into the system—but that's about it. The individual user cannot utilize the computing power of the other computers in the system or manipulate a remote data base. All of the calculations and functions are performed by that Big Machine in the computer center. The local "node" of the system is a slave to the master—something quite different from the equality of units found in a true local area network.

- **Multiuser system.** Again, multiuser systems are often confused with local area networks. A multiuser system, in the context of personal computers, is closer to distributed processing than anything else. Here, two or more computers have access to shared peripherals—such as a Winchester hard disk, for example—but that's about all they share. In a

sense, they work side by side for years without ever speaking to each other. Each computer accesses the data, manipulates it and sends it back to the central memory storage, where the other machine(s) can then use the information. But the computers themselves aren't communicating directly with one another. Often, in fact, each computer will only be able to access a certain portion of the hard disk; it's analogous to only being able to play the first three songs on a record album or to record only the first 10 minutes of a videotape. While some of these restrictions may also apply to a local area network, the point is that a multiuser, multifunction system is *not* a network. The crucial element of equal and genuine computer-to-computer communication is missing.

Hooking up

Now that we've clarified what a local area network is, the next question is: How can you plug your computer into one?

Because local area networks are so new, there is intense competition among industry giants to capture the market. The result is a range of different techniques for electronically linking together the computers, and also different configurations for geographically laying out the network. To complicate matters further, major personal computers use different operating systems and different microprocessors, which are not necessarily compatible. This makes electronically linking them into one network even more difficult.

There are several different ways to physically interconnect personal computers into a local area network. The choice of one method over another in part depends on how many workstations are to be interconnected, over how large a geographical area, at what expense and for what functions.

- **Bus networks.** The most inexpensive
(continued on page 52)

A vertical sequence of ten simple line drawings of a dog, showing a progression of its head and body from a side profile to a more frontal view. The drawings are arranged in a column, with each dog's head and front legs visible. The style is minimalist, using only black outlines on a white background. The dogs are facing left, and their heads are slightly tilted upwards. The front legs are simple vertical lines with small circles for joints. The back legs are also simple vertical lines. The overall effect is a rhythmic, repetitive pattern of the dog's form.

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January 1983 PERSONAL COMPUTING 51

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NETWORKING

(continued from page 49)

sive solution to the networking dilemma is the bus, which provides something of a "poor man's local area network." The connection is provided simply by a flat cable that acts as a "bus" between the various workstations and peripherals (for simplicity's sake, we'll refer to them collectively as "nodes"). Each node, since it needs to have access to the network, simply requests access via the bus. If the line is already busy because it is in use by some other node, the new node must wait.

This bus network offers one significant advantage: The bus does not care what type of computer is on the line. It is possible to have an IBM computer and an Apple II on the same bus network, and they will each function perfectly well. However, a significant disadvantage is that the nodes on the network can't talk to each other; the flat cable provides a means of data transmission, not translation. In this sense, the bus network is really only a step above the multiuser system.

The bus network provides an economical means of hooking up several computers to shared resources, such as a hard disk, but a bus offers a relatively slow means of transmission, relative to more advanced networking concepts. However—and this is a key point—for many businesses, the bus network is an inexpensive and viable solution. If the users within the network don't have to talk to each other—for example, if the users all have fairly defined and different needs and thus do not need a true intercommunicating network—then the bus makes a great deal of sense.

- *Twisted-pair networks.* A step above the flat cable bus network, both in performance and cost, is a twisted-pair network. This network is just what the name implies—a pair of wires that are literally twisted around each other, like the wires inside a telephone cord, to minimize potential

interference from outside signals. To date, the great majority of computer networks have been linked by twisted pairs. Firms such as Corvus Systems in San Jose, Calif., and Nestar in Palo Alto, Calif., have made significant commercial inroads by offering twisted-pair networks as a means of hooking up all those personal computers currently in place in businesses.

The twisted pair provides fairly fast data-transfer rates, as far as local area networks are concerned—approximately one-million bits of information per second for the Corvus, somewhat less for the Nestar. Either data rate is quite sufficient for many companies, particularly when personal computers are involved, since the overall demands on the system are not very great. Imagine, however, the needs of a commercial bank—where a dozen or more branches might want to simultaneously transmit the day's transactions to the central office. That million bits per second can become inadequate pretty fast; so obviously some care must go into selecting a networking technique.

One other limitation of the twisted-pair network is distance—the twisted pair works well over distances of up to just about 2000 feet. Since most businesses within one building do not need wires running more than a few hundred feet, the twisted-pair concept works fine. But if you need to have computers linked up over a distance of up to a mile, you would either have to use actual telephone lines or move up to the next rung on the network ladder.

- *Baseband coaxial networks.* This is the next rung above, and in terms of publicity and attention, certainly the most important element in networking. Why? Speed and distance—up to 10-million bits per second at distances of up to a mile. Ethernet, developed in its current form by Xerox Corp. in Dallas, Texas, is the prime example of such a network. A special coaxial cable is

laid down, permitting any number of computers to be linked into the network with a capability of transmitting the equivalent of 500 pages of text per second.

Interestingly, the baseband coaxial network shares the same disadvantage as the bus network—only one user can access the system at any given time.

- *Broadband coaxial networks.* This is strictly the high-rent district as far as networks go. In this technology, multiple cables allow even faster access to the system by even more users. Unlike the baseband coaxial network, where for each user it's first-come, first-served, a broadband network routes your request to the first open channel. The broadband coaxial network also may permit the successful integration of voice, data and video-transmission techniques, and many cable-television companies are exploring this technology for institutional cable networks in large cities. Thus, the old science-fiction staple of the "business meeting" of the future may come true—wherein all participants can see and hear each other, as well as exchange information via computer.

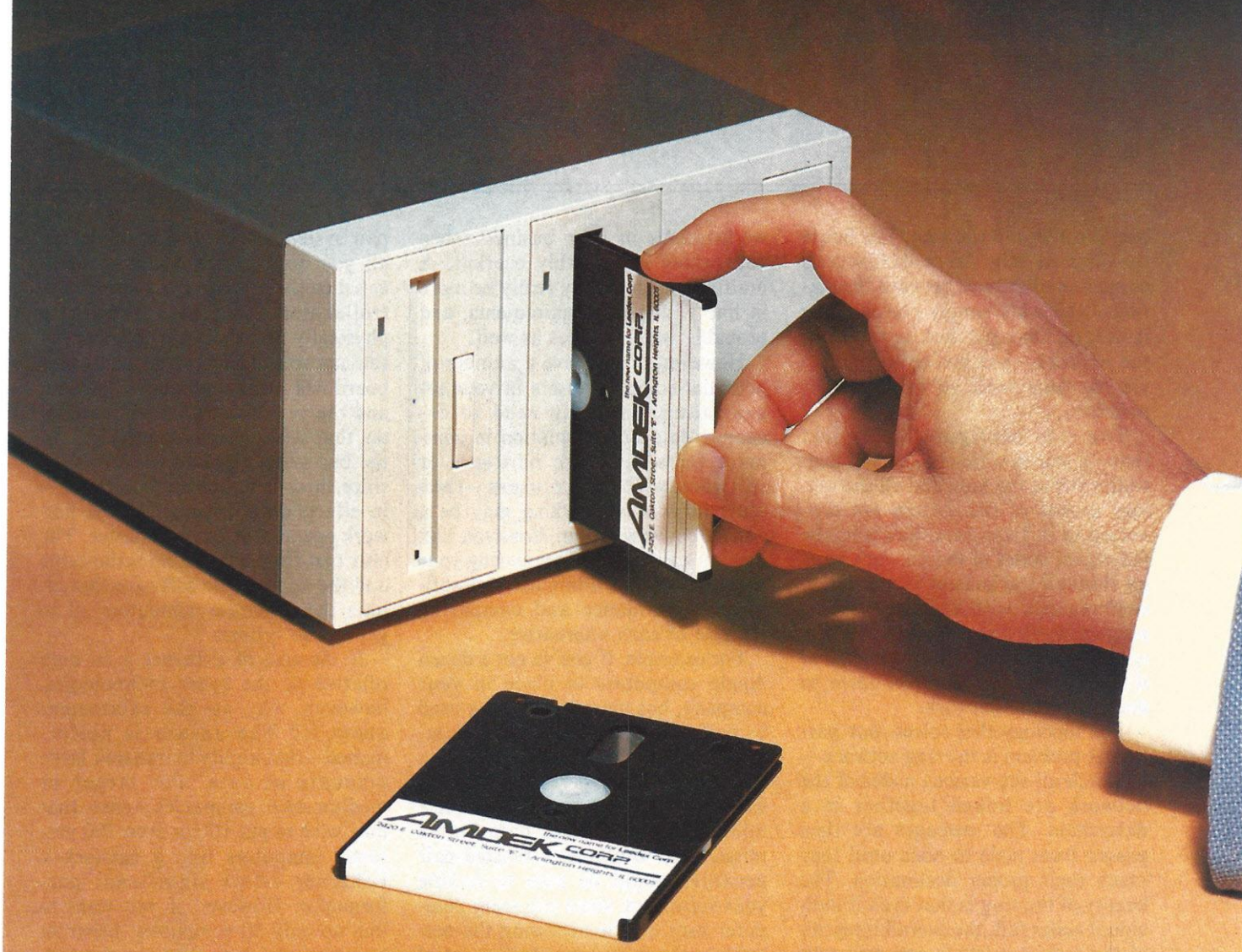
Of all the competing networking technologies, broadband is the furthest in the future for commercial application. For certain applications—government security, for example—broadband may have viability. But the cable costs upward of tens of thousands of dollars per mile to install. It's unlikely that most businesses, faced with that kind of cost, will opt for broadband coaxial networks. A bus, twisted-pair or baseband cable network will serve their purposes well at much lower cost.

A question of pattern

The final aspect of networking is topology—the actual geographical configuration of the network. What does it look like?

Three configurations are important in the world of networks: the

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CIRCLE 18

Networking personal computers permits shared computing ability for completing complex tasks.

bus, the star and the ring. The bus is the simplest—the flat cable functions as a common carrier between the stations, which are simply placed along its length. Once patched in, you're on the network—but you've still got to vie for time with all of the other members.

The star configuration is just that—a star in which the master controller sits at the hub, and all the various spokes of the system are connected to it. Even here, however, the individual nodes of the network must go through the master controller to communicate with each other. This permits more direct control over the system—with the disadvantage that if the central controller goes down, so does the entire network.

The topology that solves that particular problem is the ring network—in which all the various nodes of the network are linked together in a daisychain. The messages are then passed from node to node until they reach their proper destination. The beauty of the ring is that even if individual nodes fail, the overall integrity of the system is left intact; messages can still be transmitted from one workstation to another.

To review: There are four basic network technologies—bus, twisted pair, baseband coaxial and broadband coaxial. And there are three major network topologies for personal computers—bus, ring and star. If you apply a matrix to all of these categories, the networks available to fit your needs emerge.

TECHNOLOGY	TOPOLOGY
Bus	Bus
Twisted pair	Star
Baseband	Star or Ring
Broadband	Star or Ring

Putting it together

What technologies are likely to succeed? What is appropriate for you? And do you even *need* networking at all?

In truth, not everyone needs a network. If you plan to have two or three

workstations in your business, then networking is probably overkill. A multiuser system may really be more in line with your requirements, and probably your finances as well.

However, if you have a number of potential computer users in your organization, and they need to exchange data or information in computer form—or share hardware or software with other users—then some form of networking may be a cost-effective solution. *How* you link them is a function of comparing your requirements for minimum and optimum performance and comparing the cost of each alternative.

For example, if you've got a dozen Apple computers in place in your company, but most of them are used by professional or managerial personnel for individual projects, then a lower-cost, lower-performance network may be your best choice. At a million-bits-per-second data transmission, for example, a twisted-pair network should be able to handle your work load, since not every computer user will be accessing the network at the same time. In fact, most users may actually only use the network for a few minutes each day. The rest of the time may be spent using the computer in a stand-alone mode for individual jobs.

If, however, you have a significant number of workstations scattered throughout a city, a coaxial cable network may be more effective. Again, however, your selection of the network partially depends on the work level. In a large network system, if the users are likely to use the system often—to send messages by electronic mail or to access a central data base for financial information—then you might want to consider the extra headroom that the 10-million-bits-per-second transmission rate gives you with a baseband coaxial system.

The typical *per user* installation cost for the baseband coaxial network Ethernet is about \$1000 per user. The cost of bus networks and twisted-

pair systems is far less; in the latter, all you need is one computer dedicated to the system as a master controller and then the hardware to physically link the other members of the network. The initial controller board will run a few hundred dollars, and the per-unit installation cost after that will be significantly less. In the bus system, the cost is even less, since there is no master controller—in effect, every member of the network operates as its own master. The only cost for a bus system is the cable and the appropriate software that allows the disparate computers all to get on the system.

If the cost of Ethernet is so high relative to the other technologies, however, why all the excitement about it? The answer is performance—that ability to transmit large amounts of data. For larger or medium-size companies—ones that may wish to put 100 or even 200 personal computers into a network—Ethernet offers significant performance. However, if you want to link up only 20 computers, Ethernet becomes very expensive per computer, and other network technologies may be more cost-effective. As with many aspects of personal computing, one technique is not necessarily inherently better than the other; it's just that real issues of cost and performance must be measured against what you really intend to do with the system.

The key element in selecting a network for your needs is one of planning—both by you, your staff and the dealer you've selected. Networking is not a subject for the faint-hearted; there are problems with simply stringing cables—such as signal interference from other electrical products—that require some degree of sophistication to solve. Not every computer salesman is capable of answering questions in this area. Shop around. Check references, if your dealer has done some type of net-

(continued on page 177)



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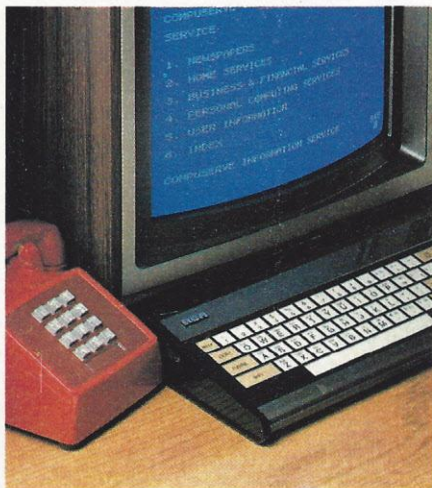
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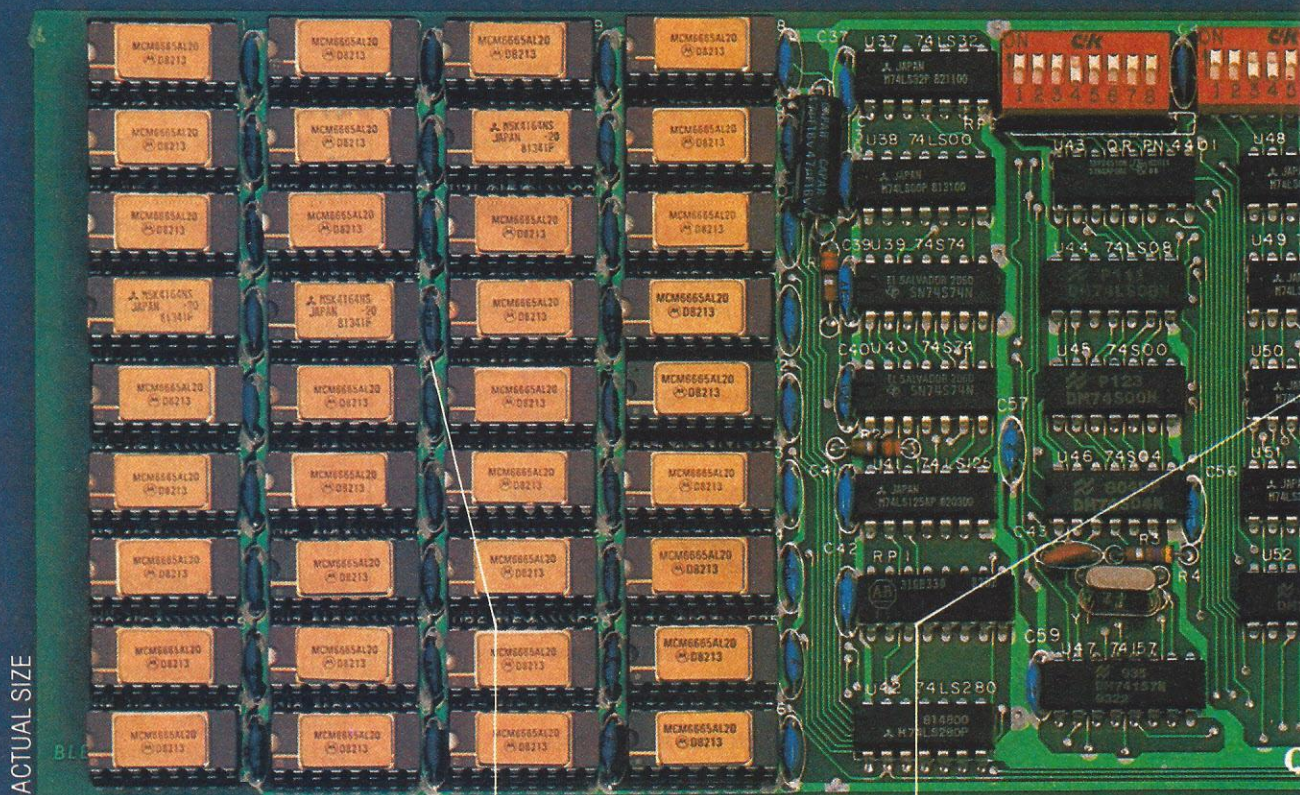


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CIRCLE 22

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Museum Pieces These Computers Are Not

They're teaching machines and, although their use in two California science museums has only begun, the possibilities seem endless. Kids (as well as adults) simply can't resist the temptation to learn

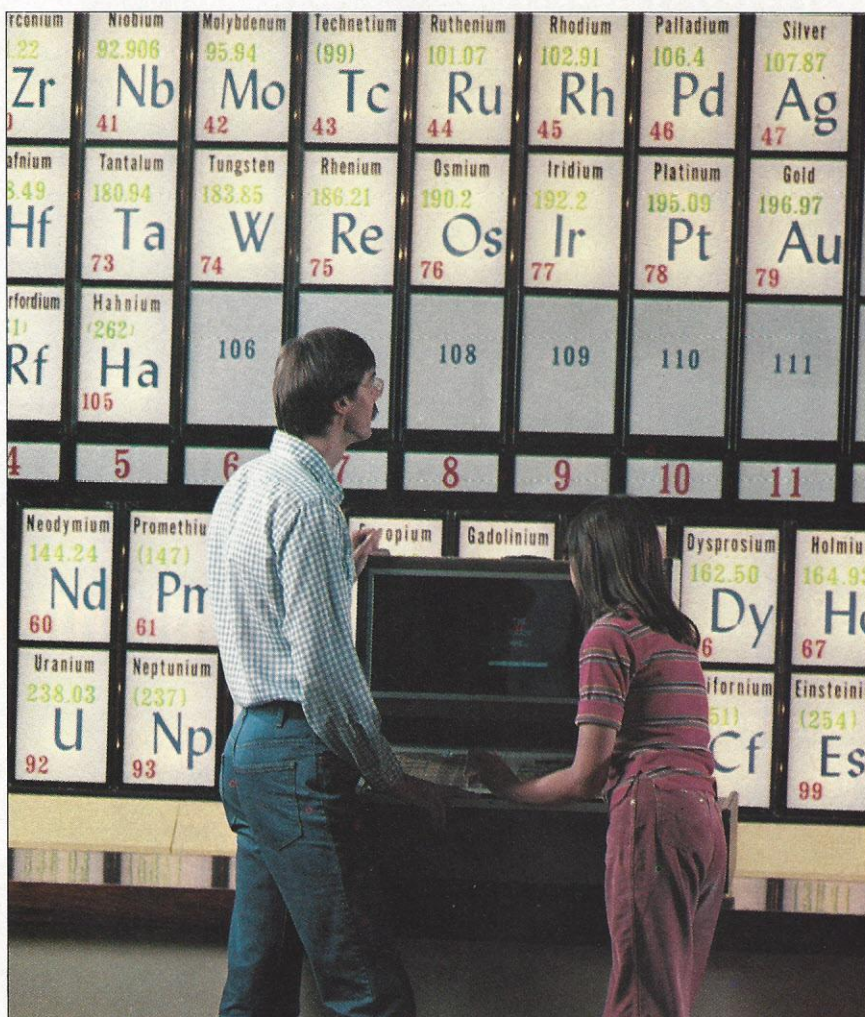
by Michael Rogers, Senior Editor

The arrival of the first small computers in an educational institution usually means one thing: It's time to start teaching about computers.

But it's also possible to do far more with a small computer when it's viewed as a tool of the imagination. Two science teaching museums in the San Francisco Bay Area are on the leading edge of this creative process—a process that may ultimately change museums all over the world.

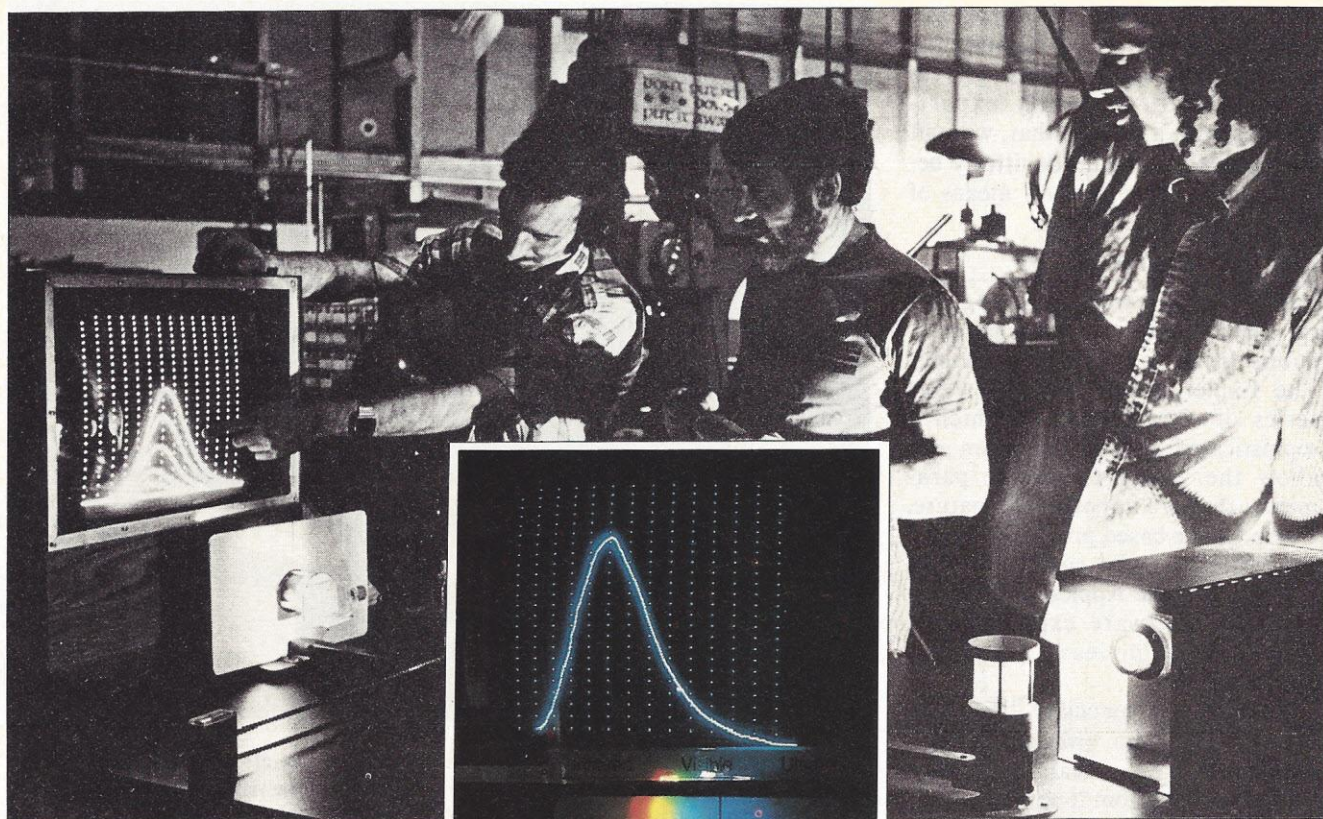
The Exploratorium, now 12 years old, is an internationally known museum started by Frank Oppenheimer, brother of Robert, to teach about natural phenomena with practical, hands-on exhibits. It is housed in a dark, cavernous space close to the Golden Gate Bridge. Tens of thousands of square feet of floor space are dotted by brightly lit exhibits that demonstrate everything from the principles of optics to the nature of the spoken word. The random, flexible layout of the Exploratorium accurately reflects the ongoing, constantly changing nature of its work.

The Exploratorium staff begins by defining the problem carefully and only then deciding what the appropriate means to solving the problem is. A good example was when, back in 1977, they set out to make the notion of exponential increase visible, preferably in a way visitors could interact



At the San Francisco Bay Area Lawrence Hall of Science, an Apple II brings the periodic table of elements to life for this father and daughter. The computer is connected to three video screens and controls lights behind each element's box on the chart.

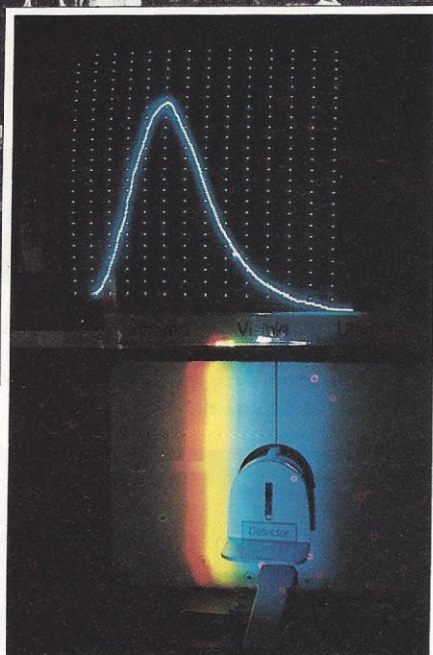
photo by Lee Youngblood



with. Many potential exhibits were considered—the famous ping-pong ball/mousetrap array, for instance. This involves setting a large number of mousetraps, closely packed together, with a ping-pong ball balanced atop each. When another ping-pong ball is thrown into the array, it sets off a rapidly increasing chain reaction of flying balls and springing traps. It's a vivid demonstration, but not terribly practical for everyday use. After each execution, it takes hours to reset the traps and replace the balls.

Enter the personal computer. Exploratorium staffers cast an eye on one of the first Apples to come through their door. Along with programmer Norman Mainwaring, they came up with an approach that illustrates exponential growth in a graphic, interactive fashion.

The exhibit, "Survival of the Fittest," allows the visitor to compare



Exploratorium staffers examine their hot light exhibit, in which a spectrum illuminates a photo cell. In turn, a personal computer graphs the energy curve.

how even the slight differences in birth rate can affect two populations of creatures in nature, based on the principle of exponential growth.

You sit down at a wooden desk, topped with a Trinitron television. The screen instructs you to choose a growth rate for a "blue" population. Using a few dials interfaced with the barely visible Apple, you can set the program so that the blue "birth rate"

is very slightly greater than the birth rate of the "gold" population. When the start button is pushed, the populations begin reproducing. The screen shows the number of generations, the number of individuals in each population and then real-time graphs that show the comparative rise in one population over the other.

Dramatically, one part of the screen is boxed off. Blue and gold dots begin to appear there, something like bacterial cultures on a microscope slide. For the first 20 seconds or so the blue and gold dots seem to appear at about the same rate—and then suddenly the blue overwhelms the gold, covering the screen. A fundamental but subtle law of nature becomes obvious: Even a slight difference between the growth rates of two populations can ultimately cause a great disparity in numbers, thanks to the principles of exponential growth.

A similar demonstration could be

Photos by Nancy Rodger

EDUCATION

done with animation, of course. But with the computerized exhibit, the visitor can change the relative growth rates himself—actually experimenting with a process that, without this simulation, would be utterly beyond the average person's means of testing or comprehension.

Less gravity please

Simulation is clearly one of the greatest contributions that personal computers bring to teaching museums. The Exploratorium plans a whole series of simulations, in which a sophisticated graphics program will allow the visitor to change parameters that are impossible in nature. These will be based primarily around single-board, 16-bit computers from Intel (with some Apples and Ataris), using the software expertise of a programmer on leave from that manufacturer.

Rob Semper, associate director of the Exploratorium, gives an example: One could have a real nozzle with water shooting from it next to a CRT display of the same thing. The exhibit would deal with what factors influence the angle at which water leaves a hose. With the real nozzle, the visitor could adjust the water pressure and the direction of the nozzle. Then, with the computer simulation, he could also change such factors as gravity. What if it was on a different planet? What if the atmosphere the water passed through was more dense? "By making these qualities variable," says Semper, "the visitor gets a better understanding of what part they play in real life."

Other simulations might include a bouncing ball, wherein you could vary the gravity, the air drag and the resiliency of the ball itself. Or a screen display of a simulated organ pipe, next to a real one, would show how a standing wave creates a tone, both on screen and in real life. In standard Exploratorium fashion, the possibilities will be tested, modified and finally winnowed down to a

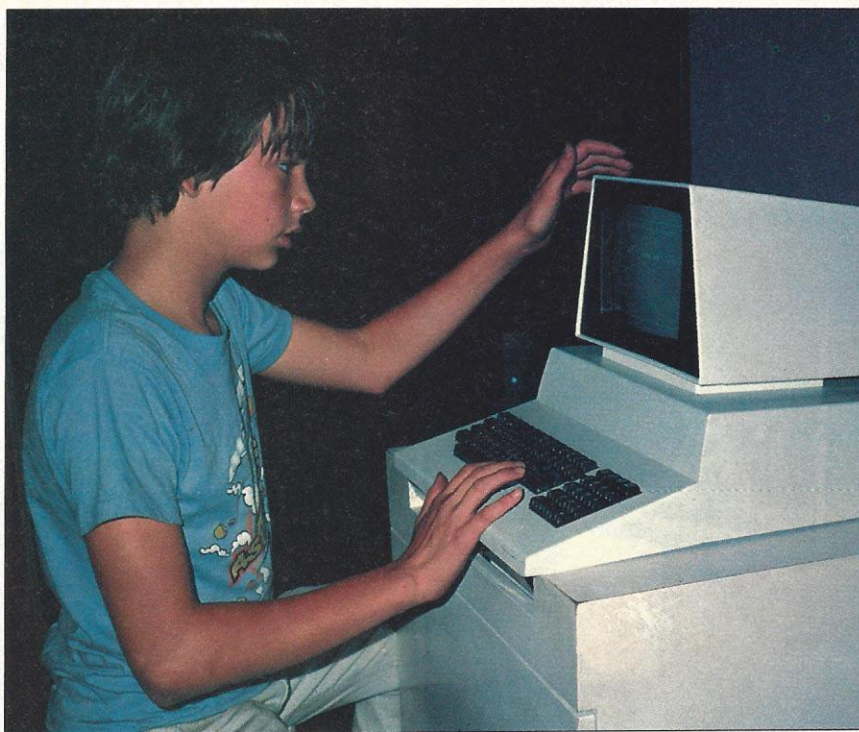


photo by Jennifer Meux White

Science museums have discovered that one thing kids will always read is a computer screen (above). The Exploratorium's Voice Dissector lets the visitor see just what makes up a spoken word (right). The "Survival of the Fittest" exhibit colorfully teaches both a law of nature and the concept of exponential growth (below).

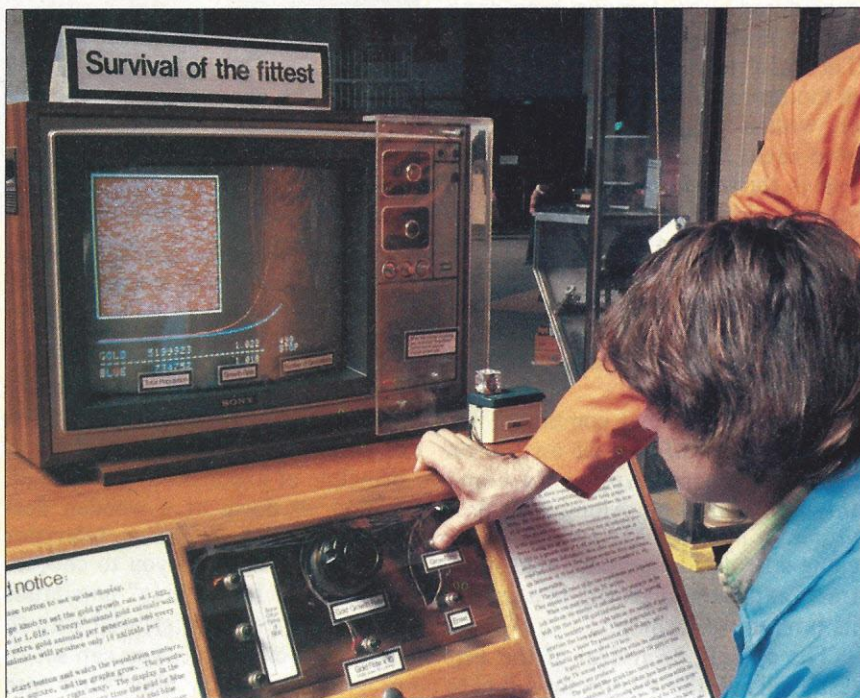


photo by Nancy Rodger

*Computers in museums can
make the invisible visible.
They can illustrate
inaccessible phenomena.*

handful that work well. Then plans will be made available to other science museums throughout the world.

Across the bay from the Exploratorium is the Lawrence Hall of Science, a modernistic, concrete building perched high in the green hills above the University of California at Berkeley. There, personal computers have spawned a similar interest in simulation. Perhaps the most spectacular will open this spring, when visitors will be able to stand in front of a 20-square-foot video screen

museums can also make the invisible visible—more generally, they can illustrate phenomena that aren't immediately accessible. At the Exploratorium, an example is the "Speech Dissector." This is basically the use of an Apple II as a digital speech recorder, with a few clever twists thrown in.

You sit down at a desk, with a CRT in front and a small microphone to one side. When you push the "Record" button and talk, about a second's worth of speech is instantly

just how complex the makeup of even a single word can be.

In this case the primary add-ons to the Apple were simply an analog-to-digital (A-D) converter (to put the speech in a form in which it could be stored and processed in the computer) and then a digital-to-analog converter to turn it back into sound. Because of the wide, dynamic range of human voices, a "compander" was also added to compress the sounds prior to processing and to re-expand them afterward.

How real is real?

Similar modifications went into another Apple II application at the Exploratorium, called "Hot Light." The purpose of the exhibit is to demonstrate, in a practical way, a fairly abstract concept—that the energy emitted by a light bulb is actually distributed unequally across the spectrum, and, indeed, that only about 10 percent of that energy is in the form of visible light.

The Apple—once again using an A-to-D converter and a graphics program—lets you prove this to yourself. Light from a 200-watt incandescent bulb is directed through a prism, creating a spectrum on a white background. You can move a sensitive photocell through the spectrum, from the ultraviolet through the visible colors into the infrared, as the Apple instantly graphs a curve illustrating the relative energy of each portion of the spectrum.

The design of this exhibit raised a larger question. As it developed, the material of the prism that creates the spectrum had its own absorption characteristics, which skewed the curve of emitted energy slightly to one side. Bob Semper, co-creator of the exhibit, initially compensated for this in the computer's software. "With the compensation," he says, "the curve came out just like an illustration in a physics textbook." He realized, however, that once he'd started manipulating the data to give a

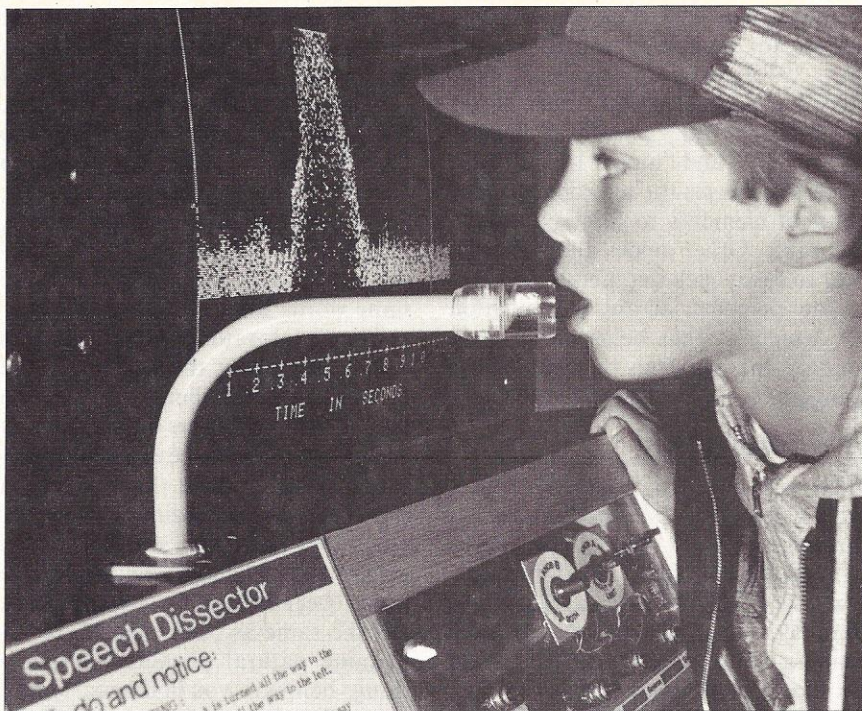


photo by Nancy Rodger

and land, in real time, a lunar module on the surface of the moon. Then they'll be able to vary the situation: landing the craft with more fuel on board or taking off carrying an extra thousand pounds of rock specimens.

Ultimately, visitors at the Hall should be able to "land" a spacecraft on every planet in the solar system—actually experiencing the gravity and atmospheric conditions of each planet—in what will be a truly graphic astronomy lesson.

Besides simulations, computers in

graphed as a burst of modulation on the screen. Then you can push buttons to hear the phrase played backward, forward or very slowly. The backward mode yields some surprises: "Yes," predictably, becomes "say." "Who's that?" becomes "that's who." "Oil" remains "oil." Perhaps the most educational aspect of the exhibit is an additional control that allows you to move lines on screen, to isolate a certain part of the graph and then to replay only that portion, creating a practical sense of

“One reason computers are so fascinating to people is that they offer small-scale incremental problem-solving. You’re never overwhelmed.”

perfect display, he might as well have just generated the whole curve inside the computer. He went back to using the computer to represent the data as generated by the exhibit’s visitors—imperfect, but real.

When every day is sunny

This leads directly to a concern expressed at both the Exploratorium and the Hall of Science: The viewer must always have some way to trust the simulation that the computer offers. “It’s interesting,” says Jennifer White, Director of Exhibits at the Hall of Science. “People who know computers, and know a bit about programming, tend to trust that what the computer does is an accurate model. But we have to be careful that people who aren’t familiar with computers don’t get the feeling, ‘Oh, it’s a computer, it can do anything.’”

That’s the rationale behind pairing real models with computer simulations at the Exploratorium. The Hall of Science has a similar blend of real and simulated in the planning stage now—but on a grand scale. Outside the Hall, on a terrace with a stunning view of San Francisco Bay, is a striking 18-foot-tall granite sculpture called “Sunstones II.”

Like a streamlined Stonehenge, the sculpture can act as a complex astronomical observatory, indicating through shadows and alignments everything from the vernal and autumnal equinoxes to “local solar noon.” The limitation, of course, is that most visitors see it only once, with the sun in a single position in the sky.

The elements revisited

Personal computers can add new life to old exhibits as well. At the Hall of Science, for example, one room has been dominated for 15 years by a giant version of the periodic table of elements, 10 feet high and twice as wide. It was the sort of static exhibit that people tended to glance at once, and then walk past. Now, thanks to an Apple II and a grant from the

National Science Foundation, it’s one of the most popular exhibits in the museum.

In front of the giant chart is the Apple with a new keyboard. (As an ongoing experiment in determining what keyboard configuration is most accessible for the average visitor, this one is in numeric and alphabetical order.) The computer is connected to three video screens and, in addition, controls lights behind each element’s box on the chart.

Once the computer has loaded the program, the visitor can choose from a menu that comes on screen. One choice, for example, is called “What’s in . . . ?” A range of keys on the keyboard are labeled with everything from “air” and “water” to “penny 1793-1855” and “nickel 1946-1981”; each key causes the appropriate constituent elements to light up on the big table. Other modes allow the visitor to easily pick out metals, or man-made elements, or any combination of categories that helps make sense out of the apparently random arrangement of the periodic table.

Accessible nibbles

The most impressive part of the program, however, is a demonstration orchestrated by the computer in which the temperature of the universe is gradually raised from absolute zero. Each element on the table undergoes the transitions from solid to liquid, and liquid to gas, by first blinking and then staying permanently lit. The relationships among the families of elements become very real as the temperature rises (the screen comments at various points: “-346 degrees—noon temperature on Pluto” or “431 degrees—paper catches fire”), and the big periodic table becomes positively animated with flashing lights. After several minutes, the final element—hafnium—vaporizes at 9700 degrees Fahrenheit, and the screen over the keyboard announces, “The Universe is now a total gas.”

“A problem with all museums,” says White, “is that exhibit designers have all this information they’re excited about, and they want to tell everyone everything all at once. With computers you can put the information in accessible nibbles. You can tell people just what they need to know at that point in the exhibit. Or you can set it up so that if they want to learn more, they can go further.”

According to White, an unfortunate truism in the museum business is that visitor interest in an exhibit tends to decline in direct proportion to the amount of printed material surrounding it. The one exception is the computer screen. “People will read what’s on the screen,” she says, “because they want to know what to do next.” She’s even seen kids who haven’t really yet learned to read, staying in front of a computer screen, laboriously sounding out the words—something they wouldn’t do if those same words were printed on paper.

The Exploratorium’s Semper is less certain about the ultimate value of on-screen text, but he echoes the notion that computers make museum learning a more accessible, step-by-step process. “I think that one reason computers are so fascinating for people is that they offer small-scale, incremental problem solving—you’re never overwhelmed at any one point. It’s the same as our approach to explaining natural phenomena. These things bombard you in the real world, but we break them down into parts so they’re more accessible.”

A problem at both museums is deciding at which audience to pitch a given exhibit. The explanation that satisfies a sixth grader won’t appeal equally to an adult with some college science education. When explanations are computer-generated, however, each visitor can tailor the length and complexity to his own desires. “That means that to make the exhibit work for a broader audience,” says White, “you just have to write additional software—and that’s a lot

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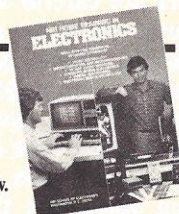
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cheaper than building a whole different exhibit."

A colleague of hers at the Hall, Robert Cremer, adds that at some point museum computers may be so sophisticated that they'll simply ask the visitor for his age and background, and then automatically tailor the explanation to the correct level.

The learning process can go both ways. Another benefit of using a computer in an exhibit is that it allows the museum to gain more information about its visitors. Programs can be designed that record how the machines are used—what questions are asked most often, what confusions come up in using the device. At the Hall of Science, one computer has even recorded an interesting sabotage pattern among teenage boys. It's so common that it's been given a name—"Gorge"—and occurs when teenagers attempt to overload the computer by piling in as much information as they can. All of these data, plus actual observation, go into perfecting each exhibit. "We assume that the visitor is always right," says White. "The program is wrong. Our best ideas aren't worth a damn if they're not accessible to people."

On the other hand, though, both the Exploratorium and Hall of Science designers are careful not to allow the computers to do too much or to be overly simple. At the Hall the computers in exhibits are relatively easy to use—simplified keyboards, for example, are put over the originals, or important keys are color coded. "But you can make things too simple," says Robert Cremer. "Sometimes, a little roughage is good for the body. We don't want people to come away with too much of a sense of control and then have their next contact with computers be a real shock."

Equally, says White, programmers are extremely careful not to let the computer do too much, thereby turn-

experience. "It's possible to set things up so that you just push a button and something happens—but the best approach is one in which you have to keep doing something in order to keep the computer working. If anything is passive, it should be the computer."

One area both museums agree about is the remarkable durability of their personal computers, considering the amount of use—and abuse—the public gives the machines. Both museums will have their exhibit programs on disk—which means they'll have delicate disk drives in almost constant operation, day in and day out. (The Exploratorium doesn't plan to press its luck, however; it's now putting its programs into ROM, to decrease the number of disk drives.)

The Hall of Science has a fairly simple stand-alone module that contains an Apple II Plus monitor, providing maximum protection without actually hiding the machine. The keyboard is protected by a plexiglass box, five inches high and open at the front, allowing fingers to go in but preventing pounding and a random Coke spill.

Galileo's shoes

The application of personal computers to museum use has clearly only begun, but it will ultimately change the shape of teaching museums. And just as computers don't necessarily have to teach computing, neither do they have to stick purely to science—even in science museums. At the Exploratorium, for example, one computerized exhibit demonstrates some very basic concepts of language and the manner in which IF/THEN statements shape our thinking.

The possibilities are clearly endless and, at the same time, the appeal is great. Jennifer White likes to describe the two most popular kinds of exhibits at the Hall of Science. One is a petting room, where visitors can

"One reason computers are so fascinating to people is that they offer small-scale, incremental problem-solving."

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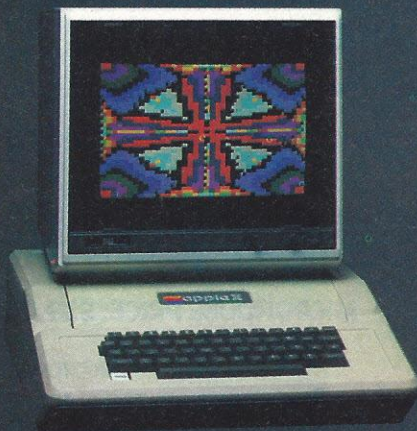
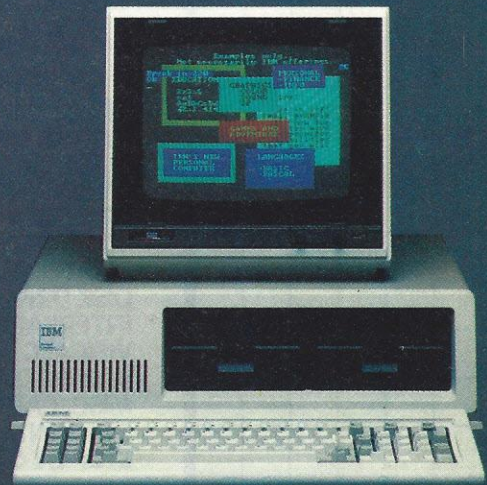
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When The Goal Is The Best Solution

Sifting data—lots of it—is what traffic engineering is all about. Here's how personal computing produces answers, not just *an* answer, to problems with many hidden subtleties

by J. A. Allen

As once-small towns grow more and more populated, a recurring retailer's nightmare confronts local merchants. Potential shoppers drive down Main Street, filled with a desire to stop at the familiar downtown stores. But they encounter a significant problem: Main Street has become so crowded with automobiles that it's almost impossible to find a place to park. After a few frustrating tries, the shopper's urge to buy subsides. The customer is lost, perhaps forever, to the nearest shopping mall, 10 miles out of town but with abundant parking.

A hopeless situation? Not really. Enter the traffic engineer. He is a data sifter. And now, armed with a personal computer, he can sift more data and often come up with surprisingly simple solutions.

The answer to any congestion problem resides in management of the people moving about and their physical environment. Extensive raw traffic data (for example, how many cars are parked on a given street each hour of the day; how many drivers pass through Main Street on each weekday or weekend) must be garnered and analyzed repeatedly over a

period of weeks or more to reveal the true pattern of flow and congestion. This work, as tedious as it is, has long been processed manually, and the art of traffic management has suffered. Now that it's done on a personal computer, the "imperfect art has been elevated to a more perfect science," in the words of Ted Ehrlich, a Woodridge, N.J., traffic engineer.

"The main advantage of the computer is that it lets you try more solutions," Ehrlich says. "When we used manual calculations, it could take a half hour to do one set of variables. After two hours you would have four sets of variables calculated. And because of the time-consuming nature of the work, you were apt to sit back at that point and say, 'I think the solution is in this direction,' and stop right there, satisfied with the probably incomplete solution that you've come up with.

"But if you do a traffic analysis on the computer, it takes only five minutes to do a calculation, including the input, so you can try 10 or 20 go-rounds on the same question just to make sure that you're making the correct recommendation to your client. In a lot of these situations, that 'just to make sure' leads you in a different direction. If it doesn't, it gives you a more solid footing for your conclusions. It's the difference between

a good solution and a really good solution."

How important that difference can be is exemplified by the case of a small suburban town in downstate New York. Recently, town officials approached Ehrlich with a case of a downtown parking logjam. The town fathers felt that building another lot—pouring concrete—was the only solution. They were, in essence, hiring Ehrlich to confirm their decision. But from past experience, Ehrlich had the feeling that his recommendations, in the end, would be different.

"To satisfy all of the interests involved, most of whom want to see action taken, many who come to me for a traffic analysis are really saying, 'What do we tear down to build our new lot?'" he says. "That solution, in the end, often satisfies no one, because all it does is displace another chunk of the downtown area. The parking problem remains unsolved. Construction is not always the solution, and I could see it wasn't in this town. Management of demand is often a much better way to go."

To demonstrate that point, Ehrlich had to do more than simply prepare an overall "count-the-cars" survey, which would probably show only what everybody already knew intuitively: Parking is at a premium and

J.A. Allen is a computer-industry editor who resides in Southern California.

"The problem was not too few parking spaces. The problem was that the already available spaces were not being used most efficiently."

TIME	LOT #1	LOT #2	LOT #3
8:00-8:30	47	39	43
8:30-9:00	51	47	47
9:00-9:30	56	65	64
9:30-10:00	78	61	68
10:00-10:30	77	68	68
10:30-11:00	73	61	61
11:00-11:30	81	69	69
11:30-12:00	81	64	64
12:00-12:30	73	67	67
12:30-1:00	83	66	66
1:00-1:30	77	55	55
1:30-2:00	73	57	57
2:00-2:30	80		
2:30-3:00	79		
3:00-3:30	66		
3:30-4:00	68		

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traffic is often at a standstill. Although such a limited type of study was the norm when he worked on a manual system, its conclusions would often lead to the knee-jerk building of a new parking lot. In order to get a true picture of the overall traffic flow, Ehrlich knew he had to make an extensive, careful analysis of the traffic patterns in several different sectors of the downtown area.

Seeing beyond the obvious

Ehrlich decided to divide the town into four separate parking sectors for his analysis. He wanted first to compile statistics for showing exactly how many cars were parked in each area at different times of the day and the average length of time they remained parked. As formidable as such a study sounds, Ehrlich knew that with a personal computer, formidable types of calculations become more possible.

Ehrlich started his analysis by hiring a group of local workers to spend an eight-hour workday, repeatedly walking one of the four downtown parking sectors in order to compile a record of daily traffic and parking patterns. At the end of the workday, Ehrlich took their written survey sheets and keypunched the information into VisiCalc format spreadsheets on his Apple II computer. Even though the VisiCalc spreadsheets were designed specifically for financial analysis, they provided a grid format that Ehrlich needed.

One spreadsheet displayed the pattern of occupancy for each of the four parking areas in town. Vertically the spreadsheet displayed the time of day by half-hour intervals (8 a.m., 8:30 a.m., 9 a.m., etc.); horizontally the spreadsheet listed the four parking sectors. In each box of the grid thus created, Ehrlich typed in the number of cars in each parking sector during every half hour of the day. He also listed the overall capacity of each area. After entering all the observed statistics, Ehrlich then had the com-

EHRlich ASSOCIATES

LOT OCCUPANCY BY TIME OF DAY

FRIDAY, OCTOBER 16, 1981 LOT #1

TIME	NO. OF CARS	% OCCUPANCY
8:00-8:30	47	39
8:30-9:00	51	43
9:00-9:30	56	47
9:30-10:00	78	65
10:00-10:30	77	64
10:30-11:00	73	61
11:00-11:30	81	68
11:30-12:00	81	68
12:00-12:30	73	61
12:30-1:00	83	69
1:00-1:30	77	64
1:30-2:00	73	61
2:00-2:30	80	67
2:30-3:00	79	66
3:00-3:30	66	55
3:30-4:00	68	57

CAPACITY 120

Ehrlich keypunched daily traffic and parking information into VisiCalc spreadsheets on his Apple II. The one above shows the number of cars in each parking sector by half-hour intervals. The one below shows how close the lots were to full.

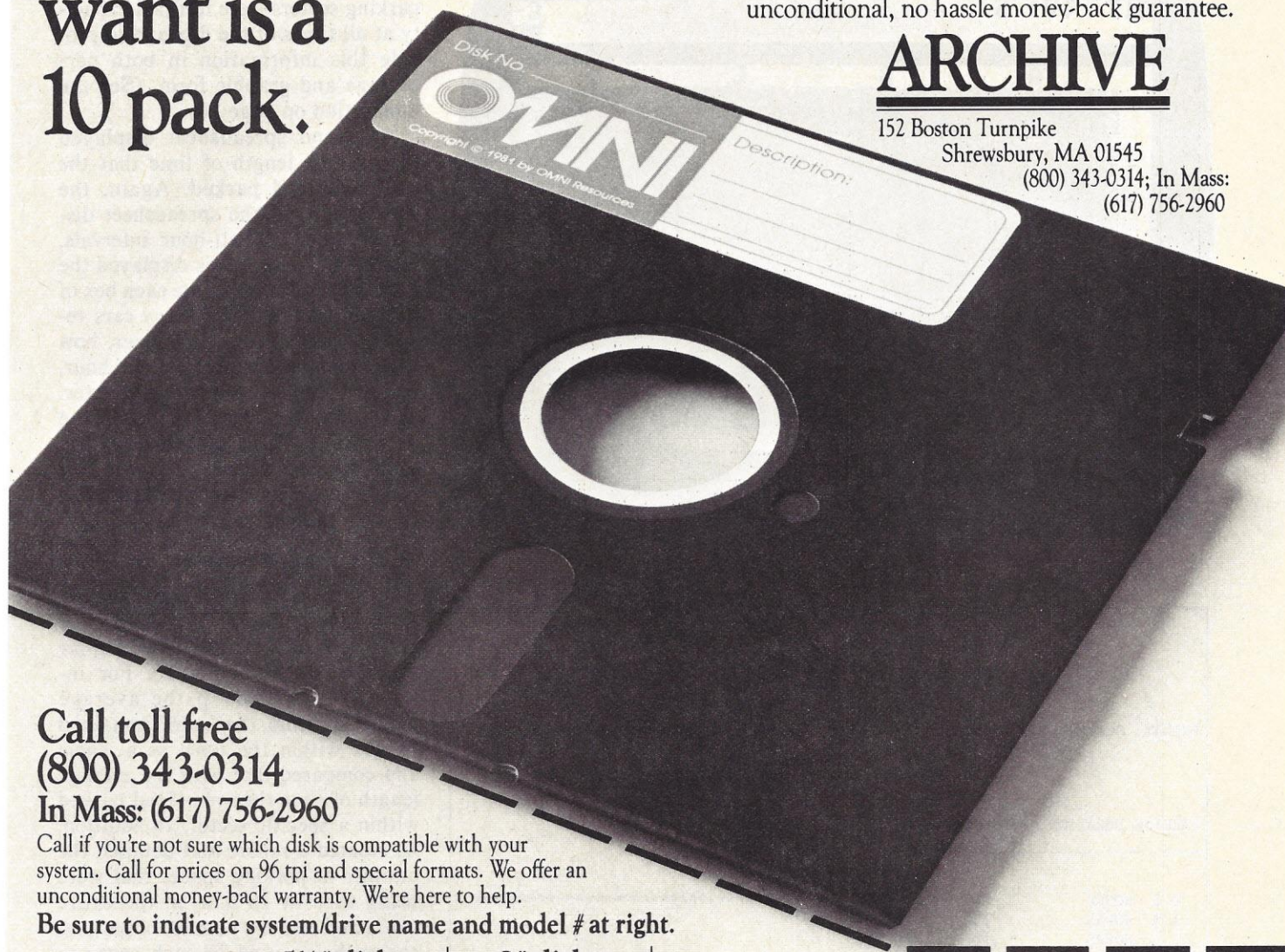
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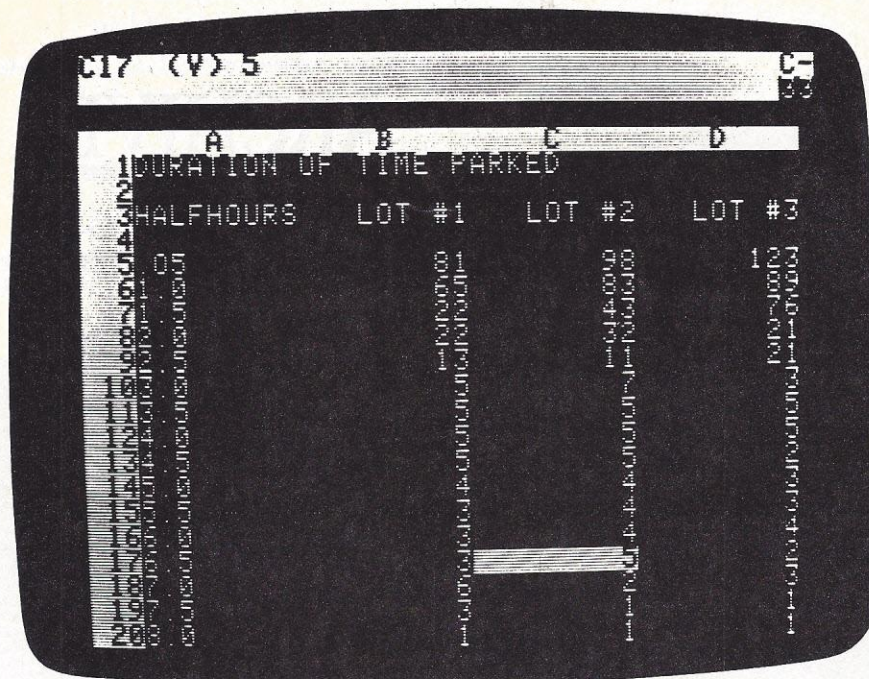
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Careful examination may point out that the problem is the businessman's fault, rather than that of the physical configuration.



puter calculate how close the four parking sectors were to filled capacity at all times of the day and to provide this information in both percentage and graphic form. (See the illustration on page 70).

A second spreadsheet displayed the average length of time that the cars remained parked. Again, the vertical axis of the spreadsheet displayed time by half-hour intervals, and the horizontal axis displayed the four sectors. But this time each box of the grid revealed how many cars remained parked for a half hour, how many remained parked for one hour, and so forth, in each parking sector. The computer then calculated the percentage of cars parked within each parking sector for each half hour of the day. (See the illustration on this page).

Really enough parking

Armed with these spreadsheets, Ehrlich was able to analyze a wide array of results by simply asking for them from the computer. For instance, he called up the average length of time that cars remained parked within the town as a whole and compared that with the average length of time they remained parked within a specific sector. In addition, he created a report that detailed the number of parking spaces that were being used at 10 a.m. in the entire town, and also the number of parking spaces being used in each separate area at 10 a.m. This type of analysis allowed him to perceive demands within different parts of town for short- versus long-term parking.

And by manipulating the computerized data, he arrived at what he feels were carefully formed recommendations. "The problem, it became clear, was not too few parking spaces," he says. "The problem was that the already available spaces were not being used most efficiently."

For the whole town, on average, only 40 percent of the public spaces were
(continued on page 77)

EHRlich ASSOCIATES			
DISTRIBUTION OF PARKING BY DURATION			
FRIDAY, OCTOBER 16, 1981		TOTAL SURVEY	
PARKING DURATION	NO. CARS	NO. CARS	
0.5 HOURS	869	*****	
1.0 HOURS	250	*****	
1.5 HOURS	103	*****	
2.0 HOURS	64	****	
2.5 HOURS	33	**	
3.0 HOURS	19	*	
3.5 HOURS	24	*	
4.0 HOURS	29	**	
4.5 HOURS	12	*	
5.0 HOURS	18	*	
5.5 HOURS	14	*	
6.0 HOURS	8		
6.5 HOURS	13	*	
7.0 HOURS	9	*	
7.5 HOURS	7		
8.0 HOURS	15	*	
TOTAL	1487		

The spreadsheet above, set up by half-hour intervals, shows the average length of time that cars remained parked. This time the breakdown (below) shows how many cars remained parked for a half hour, how many for one hour and so forth.



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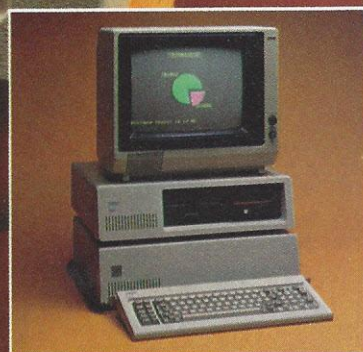
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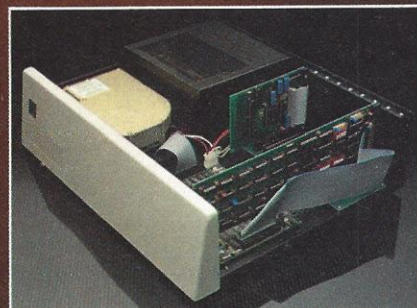
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(continued from page 72)

occupied at any time during the day. And on Main Street, where congestion was considered highest, only 70 percent of the spaces were taken, even during the peak parking hours.

Occupying premium spaces

Realizing, then, that probably the 70 percent occupancy rate on Main Street meant that the best parking spaces—those closest to the stores—were being used most, Ehrlich investigated how long the parked automobiles were staying. Again, the spreadsheets revealed intriguing findings. On Main Street, almost three-quarters of the cars remained for less than one-half hour, and an overwhelming majority of cars (93 percent) were parked for less than two hours; only a tiny fraction of automobiles (1 percent) were parked for a full eight-hour day. That pattern convinced Ehrlich that while most of the best spaces in town were being used by shoppers, a few of the spaces were being taken up by long-term parkers. Despite their miniscule numbers, this group could tilt the scale and cause a parking problem.

"Let me simplify this to explain how I reached my conclusion from the data that the computer gave me," Ehrlich says. "For the sake of argument, let's say that one lot on Main Street had 100 premium spaces, and at 10 a.m. they all were filled. Eighty percent of the cars there, or 80 cars, were parked for one-half hour; 20 percent of the cars, or 20 cars, were parked for eight hours. Spreading this information out over the full day—and considering that there are 16 half-hour segments in a day—this means that 16 times 80 cars, or 1280 automobiles, will park in 80 percent of the spots. The other 20 percent of the spots are taken up by only 20 cars for the full eight-hour period. So if you take that 20 percent of parking spaces being used for eight hours and turn them into half-hour spots, then

multiply 16 half hours by 20 cars, you can add another 320 cars to the premium spaces over a full day. And even if you turn them into one-hour spots, you are still adding 160 spaces. This all represents a significant difference that could go far in solving the town's supposed parking problems."

Even though Ehrlich's simplified example compared the effects that eight-hour parkers had on half-hour parkers, any car that parked for longer than one hour took up space that could serve several other cars during the day. Ehrlich concluded, then, that there really was no lack of parking area. There was no need to pour concrete and build another lot, but merely a need to improve management of existing spaces by turning them into short-term parking spots and then strictly enforcing regulations. So the centerpiece of Ehrlich's recommendations was short parking-duration rules in the downtown area. "I'm sure that my recommendations could not have been reached manually with assurance," he says. "I could never have gone through so complete an analytical process to get there. That would have required paperwork overkill. But, with the personal computer, any variety of calculations become mere throwaways until I arrive at the right combination of data that helps reason out a good recommendation."

Anyone can do it

Traffic-flow problems are not limited to suburban towns. Many businesses, as they grow, find themselves wrestling with delivery and parking congestion before they ever expect to. Ehrlich's traffic analysis is a sophisticated, well-planned survey. And by understanding the principle behind it—the comparison of capacity and demand—any business with a traffic-flow problem and a personal computer can approach that "really good solution."

For example, say that John Jones

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“Try a people fix, such as rescheduling things and putting more people on the job, and see if it is more feasible economically.”

owns a small manufacturing concern on a moderately busy street in a moderately sized city. His desk faces a window overlooking the parking lot. While on the phone one day he gazes out the window, and it grips his consciousness that he's staring into an incredible snafu outside.

His company had grown faster than even he had anticipated, and the proof was in the parking lot. Delivery trucks were backed up waiting to use his one loading dock, visitors were unable to get into or out of his four entrance ways and many pedestrians were walking past the major driveway and further slowing things down.

“It's really the same situation as the town parking situation,” says Ehrlich. “The businessman has to get a handle on the people end of the problem. In other words, why are trucks backing up? Why are pedestrians passing over the driveway? If someone came to me with that problem, I'd first go out and observe what's happening.”

Do-it-yourself investigation

Starting with the pedestrians, an Ehrlich-style interview would begin: “Excuse me, where are you coming from and where are you going?” People may be walking past the driveway because a traffic light is either missing or badly timed down the block. The cause of this pedestrian problem may be found by going a block or two away. “I'd make up a form and ask the people if they are doing business on this block or just passing through to get somewhere else,” Ehrlich says.

As for the truck gridlock, the businessman must begin by investigating his own business. Jones should count the number of trucks that show up, along with what they're carrying. He should examine the times the plant opens and closes, compare that with the timing of his company's incoming orders and compare that with the timing of the products he's delivering.

These questions are important

because, as with the downstate town, what might first appear to be an obvious solution, such as putting in another loading dock or widening the entrance way, may be an unwarranted investment. Careful examination may point out that the problem is the businessman's fault, rather than in the physical configuration. His order clerk, for example, may be calling every supplier and saying, “I need to have the goods here by 9 a.m.”

So, at 9 a.m., 10 trucks show up. The solution here might be simply to have the order clerk stagger his deliveries and pickups. “Management of the demand” in this case could be simply spreading the demand out over some period of time.

“You must ask yourself why those vehicles and people are all showing up at the same time,” Ehrlich says. “There's a demand to use that piece of roadway or that loading dock by many people at once. Of course, if your investigation points up that the place is busy all day, you won't be able to spread it out, except perhaps by going to a night shift.”

But there are other possibilities, too. “Try a people fix,” advises Ehrlich, “such as rescheduling things and putting more people on the job; and try a construction fix, such as building a bigger dock or widening the road. See which is more feasible economically.”


Even with his trucking problem solved, Jones will probably still have a parking-lot congestion problem as he hires more workers to tool his expanded business. With the results of his traffic survey, another spreadsheet could unlock some of the answers. “Within the spreadsheet you can evaluate solutions such as the effects of ride-sharing to reduce the number of cars, or a flex-time arrangement,” says Gary Davies, a transportation engineer with Garmen Associates in Whippany, N.J. “What happens if you get people to come to work at different times? Maybe

increasing transit ridership by changing work hours to better match transit schedules is the answer to a parking problem. All of these possibilities lend themselves to a tabular-style spreadsheet evaluation.”

The actual setup

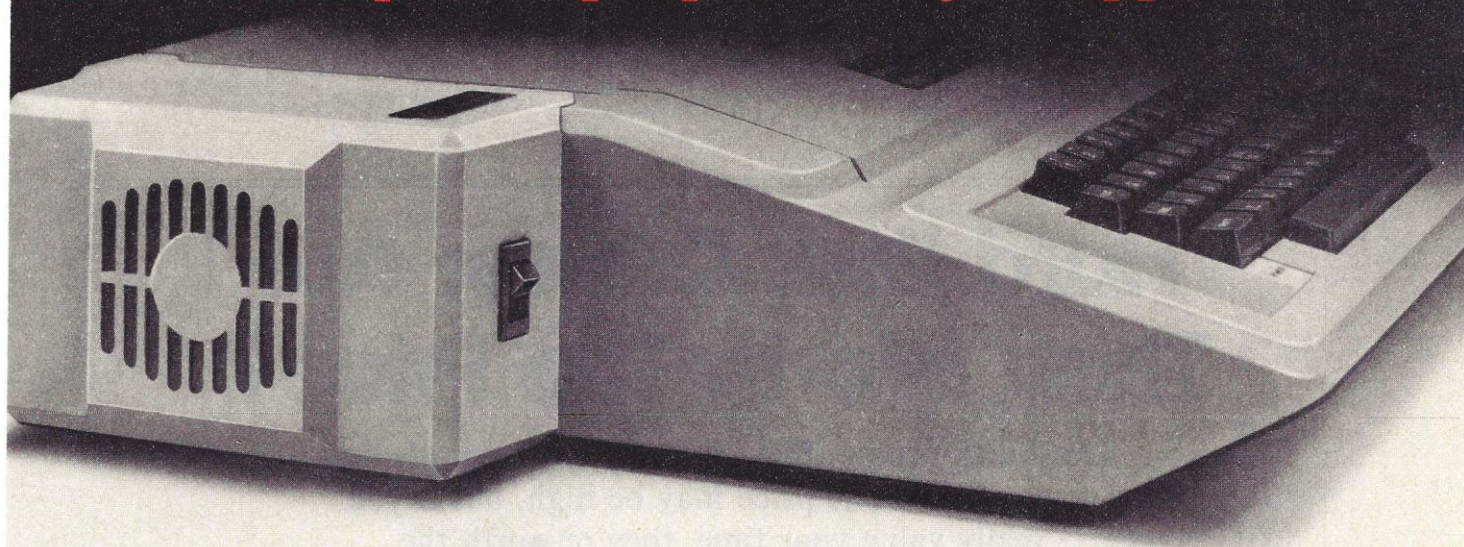
Davies would advise Jones, in this case, to set up his spreadsheet with the time of day by half hours (7 to 7:30 a.m., 7:30 to 8 a.m., etc.) as the vertical column, with the first eight horizontal columns representing “in traffic” and “out traffic” for each of the four driveways. Totals of ins and outs would be in columns 10 and 11.

“From there you would build yourself a little model of effects of different approaches,” says Davies. “Take ride-sharing, for instance. You'd work with the ‘Total’ columns and say, ‘Well, if I increase my ride-sharing to 1.5 persons per car, it might have some effect.’ Or you might want to concentrate on a particularly congested time period, such as the 7 to 7:30 a.m. arrivals. You might boost your ride-sharing for that half hour and consequently lower your incoming vehicles.”

Conversely, however, the businessman may find that he's already got an effective ride-sharing program and the changes he could implement would not be significant enough to adequately alter the situation. However, only if management of the demand is already well done can the solution to the problem reside in overhauling the physical configuration of the plant. In all cases, however, the goals are to reduce the congestion and to manage the peak load. The solution may lie in some question that has not even occurred to the businessman to ask. For additional assistance, Davies advises the solution seeker to turn to his state, county or local traffic engineering office and “pick their brains.” Also of help is the Institute of Transportation Engineers, 525 School Street, S.W., Washington, D.C. 20024. 

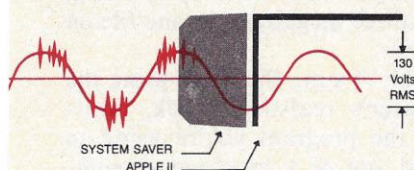
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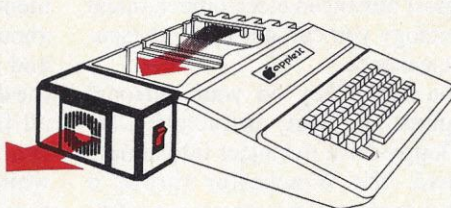


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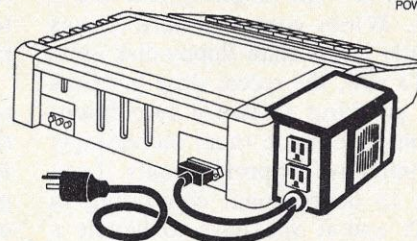
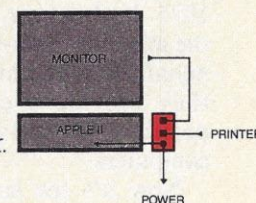
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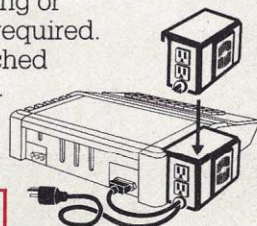
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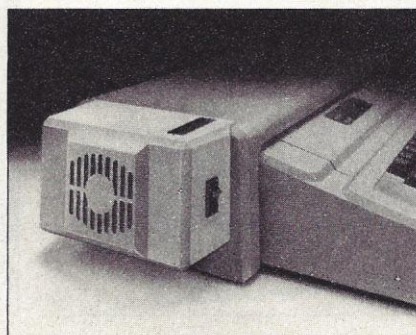
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Hard Disk Drives: Are They Worth The Price?

Hard disk drives offer speed, massive storage and convenience. The price may be high, but if you really value your time, they're worth the investment

by Lee The', Associate Editor

Winchester drives—the main kind of hard-disk technology—have been around since 1973. In that time, they have become the mainstay data-storage devices for mainframes and minicomputers, and they provide a common data repository for networks of smaller computers.

Now it's the single-system user's turn. While compact hard drives slightly larger than floppy-disk units aren't new, the recent drop in prices and growing software implementation have made them increasingly cost-effective for professionals. If you plan to do personal computing in 1983, and if you have to handle a great amount of data with speed and efficiency, you should consider hard-disk storage.

Imagine for a minute that you've just installed in your office a 5 $\frac{1}{4}$ -inch Winchester drive to replace the floppy disks that you had been using

with your personal computer. Your 5 $\frac{1}{4}$ -inch Winchester drive holds five megabytes of programs and data—that's five million bytes, or characters. Other Winchesters hold even more, but you opted for a "little" one.

There it sits, humming to itself like a math professor lost in thought. A nearly featureless box hides some of the most advanced electromechanical technology you can get without security clearance.

You tap a key on your personal computer and wait, instinctively, for the floppy drive to clatter into action. Instead, the Winchester throws a master menu onto your screen without hesitation. The screen displays every single program you use, from accounts receivable to word processing. You scroll through the list until you reach the program you want to use. The hard drive loads it in seconds.

Fifteen minutes later you use the

spooling function to print something while you continue working on your inventory-control data base, which spans three megabytes in one file on the drive.

At 11:14 a.m., the drive, using the computer's real-time clock, interrupts the program you're using to remind you of a luncheon appointment. Relieved (you'd forgotten all about it), you hit the RETURN key and resume your work. At the end of the day you tell the system to back up all files on disk that were altered or created today. You leave for home while the system is still executing that task. Later in the evening, the computer receives a long file you needed from your firm's Ottawa affiliate.

In the course of this hypothetical day, there have been few tasks that you hadn't already been doing before you purchased a hard disk. But now everything your computer does has

- 1 The Eagle File 10 (Los Gatos, CA)
- 2 The Corona Starfire 5 (Westlake Village, CA)
- 3 Corvus Systems' Disk Server (San José, CA)
- 4 Zenith's Z67 Drive (Glenview, IL)
- 5 The Tallgrass Hardfile (Overland Park, KS)
- 6 Shugart Associates' SA600 (Sunnyvale, CA)
- 7 Cromemco's System One with hard disk (Mountain View, CA)





3



4



6



7

been streamlined and integrated into one smooth system.

Computing advances

Computing was an unquestionable advance over manual operations. But even with that advance, you had to wait for the computer and disk drives to communicate with each other and transfer data back and forth. And you had to handle the floppy disks gingerly lest you damage them by bending them or touching their exposed recording surfaces, especially since you shuffled them in and out of your disk drive, often going from one program or set of data to another. More important, you sometimes had to break large files into smaller, unnatural chunks because one disk on the floppy drive couldn't handle all the data that had to be manipulated.

Now, with a hard disk drive, you've made a real advance over floppy-based computing. It cost you several thousand dollars to manage this, but within months the unit has already paid for itself by helping you raise your company's productivity.

You don't even have to require all the storage a hard disk provides. Just the way the drive speeds up your computing could make the purchase worthwhile. But how do you know whether a hard drive is for you? How do you know which one to buy? Start by examining the drive itself.

Anatomy of a Winchester

Unscrew the cover of a Winchester and you won't see much. One shielded box houses the power supply, which transforms line current into the low voltages the drive uses. The supply is enclosed to reduce shock hazard and to shield the rest of the system from stray currents. Nearby are one or more printed circuit boards, primarily comprising the drive controller (its "intelligence") and the disk motor controller. The heart of the drive—the disk—with its associated read/write head mechanisms—is sealed in another

housing. Even your dealer can't open that—it can only be breached in the kind of "clean room" in which it was first assembled. A clean room is one whose environment is very carefully controlled. The air in the room is filtered to keep dust particles out, so workers must wear special coats, hats and shoes before they enter the room. Winchester head-disk assemblies are put together in clean rooms so even microscopic dust particles don't get on the disk surface. Air gets into the disk's sealed housing through a special filter that maintains clean-room conditions inside the head-disk assembly. This practically dust-free environment is needed to keep the drive from damaging itself when it's in operation.

However, if we did manage to open that housing, we'd see one or more aluminum disks covered with a magnetically reactive coating—usually a form of purified, dried rust called ferric oxide. Diminutive read/write heads related to the ones used in tape recorders are mounted on shafts that scoot back and forth over both surfaces of each spinning disk during read/write operations.

Floppies vs. hard disks

Flexible- and hard-drive technologies resemble each other up to this point (except that floppy drives use a flexible mylar disk backing for the coating). Each uses a read/write head to move data onto the particles of the coating by selectively magnetizing those particles. A reversal of this process lets the head read the data, which the drive then amplifies and sends to the computer.

But magnetic induction, the physical phenomenon that is the basis for these operations, is an inherently weak process. The less distance involved, the better it works. This leads directly to the fundamental difference between flexible and hard-disk technology: contact. In a floppy drive the read/write head rubs against the disk during read/write operations,

The read/write head is held there by a pressure pad on the opposite side of the disk. Listen to a floppy drive in action and you can hear the rubbing, even though the disk surface is lubricated to cut down wear.

Read/write-head contact creates both problems and limitations. Floppy drives are sensitive to cigarette smoke and dusty environments; the drives require periodic cleaning because the ferrite particles rub off. And in most cases the drives don't last as long as the central processing unit (CPU) they serve. Moreover, you can't spin a floppy disk very fast without reliability falling to unacceptable levels. As a result, floppies spin at 360 rpm, which in a 5¼-inch drive slides the data-laden surface under the read/write head at from 2 to 5½ mph. That's why floppies are slow at writing and retrieving data.

The capacity of floppies can be improved by increasing data density on the disk surface. But this also increases sensitivity to surface wear and damage from small, foreign particles that might be on the disk surface. Eight-inch disks also provide more capacity—up to over one megabyte per disk—but these big floppies are even less convenient to store. In addition, they dawdle along at 360 rpm. At the edge of an 8-inch disk, the linear velocity is about 10 mph, which is hardly record breaking.

Reading a 55-mph tickertape

How about spinning the disk at 3600 rpm and increasing speed tenfold to 56 mph at the periphery of a 5¼-inch disk or over 100 mph on an 8-inch platter? That would make the drive perform. But to allow those speeds, the head must be lifted up off the surface of the disk a microscopic amount. If the distance the head is lifted over the surface is small enough, magnetic induction still works.

To move the head this microscopic distance above the disk surface, the

How do you know whether a hard drive is for you? How do you know which one to buy?

head is carried on a little wing. As the disk spins, friction between the disk surface and the air around it drags the air along with the disk. The air passing over the wing on which the head is mounted causes aerodynamic lift, making the head actually fly over the disk. The air space between head and disk is sometimes called an "air bearing." An ultrafine coating is used to fill in the minute hills and valleys in the coating for aerodynamic perfection.

A Winchester disk drive is a remarkable technological achievement. You can get an idea of the way it works by imagining you're in the belly turret of a B-17, flying one-tenth of an inch over a flat runway at 56 mph. Your mission is to read information that's been inscribed in the concrete of the runway and to write new information on the surface on command. You could probably do it, as long as the belly turret doesn't run into any obstacles. The same problem plagues Winchester disks, and that's why they're assembled in a clean room. At the speeds and clearances involved, any speck of dust would smack the read/write head like a boulder running into the belly turret of that B-17.

Although Winchesters must operate in a sealed environment, the sealed design makes the disks almost indifferent to outside air quality. And since contamination doesn't get into the sealed compartment, the disks don't need cleaning and are never removed from the drive. Thus, the drives are very reliable.

But with reliability comes a little delicacy. For instance, Winchesters don't like thermal extremes. If the temperature inside the drive housing gets too high, the heat can damage the drive's electronics. All Winchesters, therefore, have heat sinks, or large masses of metal that transfer the heat to the ambient air. Most Winchesters also have cooling fans. On the larger-capacity models, the fans can be quite noisy—something

to watch for when selecting a unit.

Winchesters are sensitive to shock, too. If our imaginary B-17 were flying over a runway when an earthquake occurred, it would crash. A Winchester drive's heads can also crash. Consequently, hard drives feature extensive shock mounting, but users must still try not to jostle their drives excessively.

Given reasonable handling, Winchester drives will last a long time. The controller circuitry in many drives can even "heal" disk damage to some extent. The controller sends the heads over the whole disk surface when the drive starts up. In the process, it finds flawed sectors where data can't be stored reliably, marks them so future data won't be stored there and moves endangered data to safer locations. All Winchester disks come with coating imperfections and develop more imperfections in service. But this controller design, combined with built-in surplus capacity, ensures that you get as much total storage as you paid for—and usually a bit more.

Removable hard disks

Hard disk drives clearly use complex technology—rigorously executed—to provide reliable, large-scale storage. A further increase in complexity has brought removable-disk hard drives on the market recently. When the cartridge is inserted in the drive, the drive initiates an elaborate 60-second purge/filtration cycle that introduces clean, filtered air into the cartridge before the read/write heads enter it. Drives are available in three configurations: fixed disk only, removable cartridge only, and fixed disk plus removable cartridge. The cartridges cost \$98 to \$159 for 5-megabyte disks.

Fixed plus removable drives cost more than fixed units, but they provide more total storage capacity. Despite the higher cost of these units, their manufacturers estimate reliability at about 80 percent that of

fixed drives. While that's not as good as the reliability of fixed disk drives, it's still very good. The ultimate durability of the removable hard-disk cartridge and drives in actual field use is still unproven, but an unsealed cartridge design used with mini-computers (called cartridge-disk technology) is well proven, and it is similar enough to make people believe their reliability estimates are at least close to the mark.

Archival storage and backup

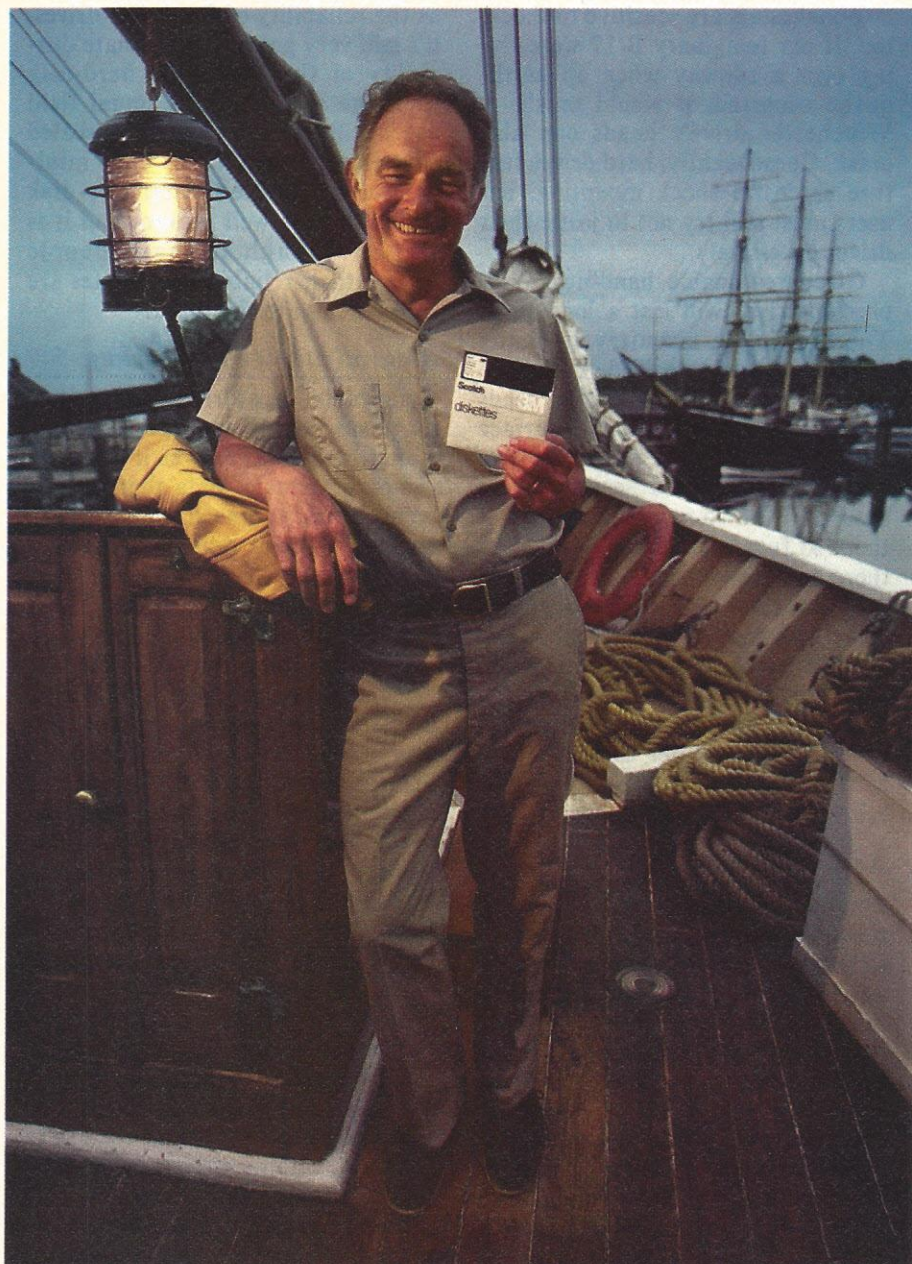
Removable disk drives serve three purposes: ready storage, archival storage and backup. Even if you don't generate reams of data that have to be archived, you need some form of backup. General reliability notwithstanding, the drive will eventually break—probably the morning you have to process payroll checks.

Backup copies stored on cartridge disks will save you from that kind of disaster, but they're an expensive way to store large archives. There are other alternatives, and the one you choose depends mainly on how your needs for ready storage, archival storage and backup are balanced. The alternatives include a second fixed drive, a streaming-tape cartridge drive, a video-cassette drive and a floppy disk drive.

If you store little archival material but want the most convenient backup, a second fixed drive works well. You just dump the first disk's contents to the second disk at the end of each day. Some drives even come with controllers for more drives. That means additional drives will cost less than the first drive did, because the added drives won't need controller circuitry. Such controllerless drives are available.

Streaming-tape cartridge systems will store several megabytes' worth of data on inexpensive magnetic tape. These systems are called "streaming tape drives," or simply "streamers," because they read data in a continuous stream from the disk. Other

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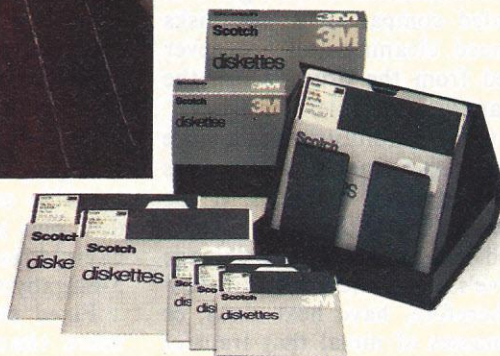
Eben Whitcomb, Owner-Operator, Dirigo Cruise Company, Clinton, CT

Eben Whitcomb runs the largest windjammer cruise business using American flag ships. He uses Scotch diskettes to keep track of thousands of names, bookings, sailing times, manifests and general ledger. While his computer saves time and repetition, Scotch diskettes assure him that vital information will be there when he needs it.

Dependable Scotch media can work just as hard for you. Each Scotch diskette is tested before it leaves our factory, and guaranteed error-free. So you can expect it to perform exactly right.

Scotch 8" and 5¼" diskettes are compatible with computer/diskette systems like TRS-80, Apple, PET, Wang and many others. Get them from your local 3M distributor. For the one nearest you, call toll-free: 800/328-1300. (In Minnesota, call collect: 612/736-9625.) Ask for the Data Recording Products Division. In Canada, contact 3M Canada, Inc., Ontario.

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3M Hears You...

3M

The Winchester's design, with its built-in surplus capacity, ensures that you get as much storage as you paid for—and usually a bit more.

SPECIAL REPORT

tape drives—start/stop drives, for instance—read data in chunks called blocks and write a block header and a block trailer along with the block of data. The computer uses the headers and trailers to find data on the tape quickly.

Since streaming-tape drives lack block identifiers, data are stored on the tape in one large chunk. Your computer can't go to the tape cartridge and find a specific piece of information. Rather, you must reload the data onto your disk and instruct the disk controller to find the piece of information you're looking for. Since the streamer will be used for archiving and backup, the relative inaccessibility is no real problem. But the speed increase (a several-fold advantage over start/stop drives and an even bigger speed dividend when these drives are compared with floppy disk drives for archiving) is worth the small price of data inaccessibility.

The Mirror system from Corvus (San Jose, Calif.) interfaces your computer to your video cassette recorder via an under \$800 system that stores data on video-cassette. Videotape was never designed for digital storage, but the Mirror makes four copies of everything it stores to ensure the integrity of the data.

Users who don't generate masses of archival data have a more economical alternative than any of the above: the floppies their system already uses. Floppies have been criticized as a backup medium because of the number of floppies it takes to back up a full hard disk and because of the hours it takes to get the job done. But new software enables users to back up data selectively—by date, volume or category—automatically sequencing diskettes for storage of more than a single floppy's data.

Winchester-drive software

Without special software this selective backup would be impossible.

More than that, it is the software that is proving a major discriminator of the Winchesters in the personal-computer market.

Mechanically, hard drives tend to be quite similar. Buyers will find the major differences in the accompanying software. In general, the software that has more options—thus making the disk drive more useful and flexible—will be more difficult than a system that has fewer options.

Drive software lets the computer make the best use of the drive's resources. Winchester-drive software generally modifies and supplements computer operating systems. Different operating systems are usually available for any given computer, and a hard drive must work with any given operating system. A hard disk drive for an Apple II, for instance, may come with software compatible with Apple DOS, CP/M and Pascal. A hard drive for an IBM could be able to handle PC DOS and CP/M-86; a Radio Shack-compatible hard drive could use any of several versions of TRS-DOS or CP/M; and so forth.

Versatile hard-disk software provides some unexpected dividends. It can allow files from several operating systems to co-reside on one disk, for example. Some software allows for dynamic file-size allocation. All hard drives require that users specify the maximum file size (and the total space allotted to any given operating system's files). Versatile software varies the actual space taken up by those files according to how much information is actually stored there. And you can change the file size specifications without having to re-enter all your data.

Hard-drive software also has to overcome the limitations that floppy drives caused to be incorporated in operating systems. Many operating systems were designed with only floppy drives in mind, so they only recognize, say, eight floppy-sized drives at any given time. But hard-

drive software can "trick" the computer into thinking it's attached to eight floppies. The software simply substitutes phantom floppies in and out of the hard drive's "active" lineup and makes the computer think new floppy disks were inserted into the supposed floppy drives. More versatile hard-disk software can also increase the effective size of each phantom floppy far beyond the normal limits of the operating system. Apple DOS recognizes 143k per floppy, for instance, but some hard drives can make it recognize 400k phantom floppies, which is more convenient.

There are enough wrinkles in hard-drive software to fill this issue of *Personal Computing*. Since your search will probably be limited to the handful of systems your local dealer can sell and service, it's most practical to look to those dealers for demonstrations of differences among the systems from which you can choose. Independent software firms are starting to offer application programs and implementation utilities now, so you should consider those along with what the computer and drive makers provide. Just decide beforehand whether easy or versatile is more important to you.

But hard disks cost plenty

The wealth of hard-disk hardware and software features gives users a lot of value for their money. There's no avoiding the fact that hard drives are fairly expensive, but expense must be weighed against factors such as large storage capacity and speed. Comparing the cost per byte of hard disk drives with the cost per byte of floppy drives, however, is useful because it lets you know exactly how much this extra storage will cost over time.

While a floppy drive doesn't have a fixed capacity, you can put diskette after diskette into the drive; and diskettes are cheap. If we compare the price of a hard drive of a given capacity to the price of a floppy drive with

SPECIAL REPORT

enough disks to equal the hard drive's capacity, the hard disk is still more expensive.

By this measure, you can plan to spend two to six times as much per byte for your hard disk drive as you would for equivalent floppy-based storage. A floppy can't hold the large files of a hard drive, of course, and that's an added, intangible cost.

Now consider reliability. Drive makers specify this factor with a parameter called Mean Time Be-

tween Failure (MTBF), which is an average of how long they think a hard drive should go between breakdowns. It's really a figure the manufacturer develops by taking the time-to-failure of the components in the finished product and statistically weighing those times according to standard, well-developed formulas. Mean time means exactly that. Just because MTBF for a device is 10,000 hours doesn't mean the device you buy will last that long. It could break after one

hour or it might go on forever. On the average, one of these devices will perform reliably until the MTBF.

MTBF clearly isn't an ironclad number, but in the absence of a reliable third-party figure, let's use manufacturer MTBFs. The MTBF for floppy disk drives is approximately 8000 hours, while the MTBF for hard disk drives is typically more than 10,000 hours of operation. This would give a Winchester drive more than a year of 24-hour-a-day oper-

HARD DISK DRIVE BUYER'S GUIDE

ALTOS COMPUTER SYSTEMS
2360 Bering Dr.
San Jose, CA 95131
(408) 946-6700
CIRCLE 300

APPLE COMPUTER CO.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
CIRCLE 301

A.R. BUSINESS SYSTEMS
1128 E. Alosta Ave.
Glendora, CA 91740
(213) 963-7213
CIRCLE 302

BMC
860 E. Walnut St.
Carson, CA 90746
(213) 323-2600
CIRCLE 303

B.T. ENTERPRISES
10B Carrough Rd.
Bohemia, NY 11716
(516) 567-8155
CIRCLE 304

CAMEO ELECTRONICS INC.
1626 Clementine
Anaheim, CA 92802
(714) 535-1682
CIRCLE 305

COMMODORE BUSINESS
MACHINES
Personal Systems Division
P.O. Box 500
Conshohocken, PA 19428
(215) 687-9750
CIRCLE 306

COMPUTER DYNAMICS
105 So. Main St.
Greer, SC 29651
(803) 877-7471
CIRCLE 307

CORONA DATA SYSTEMS
31324 Via Colinas
Section 110
Westlake Village, CA 91361
(213) 706-1505
CIRCLE 308

CORVUS SYSTEMS INC.
2029 O'Toole Ave.
San Jose, CA 95131
(408) 946-7700
CIRCLE 309

CROMEMCO INC.
280 Bernardo Ave.
Mountain View, CA 94043
(415) 964-7400
CIRCLE 310

CYBERNETICS INC.
8041 Newman Ave.
Suite 208
Huntington Beach, CA 92647
(714) 848-1922
CIRCLE 311

DATA TECHNOLOGY INDUSTRY
701-A Whitney St.
San Leandro, CA 94577
(415) 638-1206
CIRCLE 312

DAVONG SYSTEMS INC.
610 Palomar Ave.
Sunnyvale, CA 94086
(408) 773-8370
CIRCLE 313

DAYSTAR TECHNOLOGY INC.
1198 E. Willow St.
Signal Hill, CA 90806
(213) 595-6431
CIRCLE 314

DIGITAL EQUIPMENT CORP.
146 Main St.
Maynard, MA 01754
(800) DIGITAL
CIRCLE 315

EAGLE COMPUTER INC.
983 University Ave.
Los Gatos, CA 95030
(408) 395-5005
CIRCLE 316

FORTUNE SYSTEMS CORP.
300 Harbor Blvd.
Belmont, CA 94002
(415) 595-8444
CIRCLE 317

GENIE COMPUTER CORP.
31125 Via Colinas
Section 908
Westlake Village, CA 91362
(213) 991-6210
CIRCLE 318

HEWLETT-PACKARD
Greeley Division
3404 E. Harmony Road
Fort Collins, CO 80525
(303) 226-3800
CIRCLE 319

INTERTEC DATA SYSTEMS
2300 Broad River Rd.
Columbia, SC 29210
(803) 798-9100
CIRCLE 320

IQ SYSTEMS
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Anaheim, CA 92806
(800) 854-0561
CIRCLE 321

KAY PRO
533 Stevens Ave.
Solana Beach, CA 92075
(714) 755-1134
CIRCLE 322

LOBO DRIVES INTERNATIONAL
Department PC1
358 S. Fairview Ave.
Goleta, CA 93117
(805) 683-1576
CIRCLE 323

MAEZON
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Phoenix, AZ 85009
(602) 272-2815
CIRCLE 324

M/A-COM OSI
7 Oak Park
Bedford, MA 01730
(617) 275-3030
CIRCLE 325

MICROCOMPUTERS OF
NEW ORLEANS
4539 I-10 Service Rd.
Metairie, LA 70002
(504) 885-5883
CIRCLE 326

MORROW DESIGNS
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San Leandro, CA 94577
(415) 430-1970
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MOUNTAIN COMPUTER INC.
300 El Pueblo Rd.
Scotts Valley, CA 95066
(408) 438-6650
CIRCLE 328

NEC INFORMATION SYSTEMS INC.
5 Militia Dr.
Lexington, MA 02173
(617) 862-3120
CIRCLE 329

NETRONICS R&D LTD.
333 Litchfield Rd.
New Milford, CT 06776
(203) 354-9375
CIRCLE 330

NORTH STAR COMPUTERS INC.
14440 Catalina St.
San Leandro, CA 94577
(415) 357-8500
CIRCLE 331

*The wealth of hard-disk
hardware and software features
gives users a lot of
value for their money.*

ation between breakdowns. It's also five years of 40-hour work weeks. Even taking that with a grain of salt, these drives' total life expectancies should be at least several years under normal conditions.

If you buy a hard disk drive for \$2200, you'll pay about \$1500 more than you would if you simply purchased a second floppy drive. The same holds true if you buy a computer with a built-in hard drive instead of a second floppy drive.

Amortizing that price differential conservatively over three years, you'll spend \$2 a workday for the benefits that accrue from using a hard disk drive.

Some big benefits

So what do you get for \$2 a day? The most obvious benefit of a hard drive is large storage capacity. This capacity in one drive makes the computer easier to use. Storing very large files is a corollary benefit that can be a

real boon for many who work with large data bases or long documents. This is true even if you have only your files, and not your programs, installed on the disk.

But there's another benefit so great it can make the purchase of a hard disk drive worthwhile, even if you don't require the capacity speed. Here's a practical example. We compared the length of time it took to

(continued on page 92)
(chart begins on the following page)

OLIVETTI CORPORATION
155 White Plains Rd.
Tarrytown, NY 10591
(800) 431-1366
CIRCLE 332

SEATTLE COMPUTER
1114 Industry Dr.
SEATTLE, WA 98188
(800) 426-8936
CIRCLE 339

TOSHIBA AMERICA
2441 Michelle Dr.
Tustin, CA 92680
(714) 730-5000
CIRCLE 346

WANG LABORATORIES INC.
One Industrial Ave.
Lowell, MA 01851
(617) 459-5000
CIRCLE 353

PC²
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Bldg 678
Sunnyvale, CA 94086
(408) 749-8100
CIRCLE 333

SONY CORPORATION
9 West 57 St.
New York, NY 10019
(212) 371-5800
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TRANTOR SYSTEMS LTD.
4432 Enterprise St.,
Unit 1
Fremont, CA 94538
(415) 490-3441
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WICAT SYSTEMS
1875 S. State St.
Orem, UT 84057
(801) 224-6400
CIRCLE 354

PERCOM DATA CORP.
11220 Pagemill Rd.
Dallas, TX 75243
(214) 340-7081
CIRCLE 334

TALLGRASS TECHNOLOGIES
CORP.
9207 Cody,
P.O. Box 12047
Overland Park, KA 66212
(913) 492-6002
CIRCLE 341

UNITED PERIPHERALS
432 Lakeside Dr.
Sunnyvale, CA 94086
(408) 730-4440
CIRCLE 348

XCOMP
7566 Trade St.
San Diego, CA 92121
(714) 271-8730
CIRCLE 355

QANTEX DIVISION-
NORTH ATLANTIC
60 Plant Ave.
Hauppauge, NY 11788
(516) 582-6060
CIRCLE 335

TARBELL ELECTRONICS
950 Dovlen Place,
Suite B
Carson, CA 90746
(213) 538-4251
CIRCLE 342

VECTOR GRAPHIC INC.
500 N. Ventu Park Rd.
Thousand Oaks, CA 91320
(805) 499-5831
CIRCLE 349

XEBEC (UNITED PERIPHERALS)
432 Lakeside Dr.
Sunnyvale, CA 94086
(408) 735-1340
CIRCLE 356

QUALITY COMPUTER SERVICES
178 Main St.
Metuchen, NJ 08840
(201) 548-2135
CIRCLE 336

TECMAR INC.
23600 Mercantile Rd.
Cleveland, OH 44122
(216) 464-7410
CIRCLE 343

VICTOR BUSINESS PRODUCTS
3900 N. Rockwell St.
Chicago, IL 60618
(312) 539-8200
CIRCLE 350

XEROX CORPORATION
1341 W. Mockingbird Lane
Dallas, TX 75247
(214) 689-6175
CIRCLE 357

RADIO SHACK-TANDY CORP.
One Tandy Center
Fort Worth, TX 76102
(817) 390-3011
CIRCLE 337

TELEVIDEO
1170 Morse Ave.
Sunnyvale, CA 94086
(408) 745-7760
CIRCLE 344

VISTA COMPUTER CO. INC.
1317 E. Edinger
Santa Ana, CA 92705
(714) 953-0523
CIRCLE 351

XITEN SYSTEMS
16815 Hawthorne Blvd.
Lawndale, CA 90260
(213) 370-3966
CIRCLE 358

SANTA CLARA SYSTEMS
560 Division St.
Santa Clara, CA 95008
(408) 374-6972
CIRCLE 338

THOUGHT WORKS INC.
3532 W. Thomas Rd.,
Suite 2
Phoenix, AZ 85019
(602) 269-6841
CIRCLE 345

VR DATA
777 Henderson Blvd, N-6
Folcraft, PA 19032
(800) 345-8102
CIRCLE 352

ZENITH DATA SYSTEMS
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8192
CIRCLE 359

Features Of Hard Disk Drives

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
ALTOS COMPUTER SYSTEMS Series 5-5D (C)	5	Altos 5-15D, 5-5D with MP/M II	F	built-in or add-in	no	+ \$3000 (\$3990 upgraded for 5-15D)
ACS 8000-10 (C)	10	Altos ACS 8000-10	F, T	built-in	no	+ \$3000
ACS 8000-12	20	Altos ACS 8000-12	F, T	built-in	no	+ \$4000
ACS 8000-14	40	Altos ACS 8000-14	F, T	built-in	no	+ \$6000
APPLE COMPUTER INC. ProFile	5	Apple III	F	add-on	no	\$2195
A.R. BUSINESS SYSTEMS 525	5	Apple II-DOS TRS-80 I, III-DOS+, LDOS TRS-80 II-DOS IBM PC-CP/M-86 NEC 8000-CP/M	F, RW, FD	add-on	yes	\$2500
525 (2nd drive)	5	same	F, RW, FD	add-in	yes	\$1600
108	8 1/2	same	F, RW, FD	add-on	yes	\$3200
108 (2nd drive)	8 1/2	same	F, RW, FD	add-in	yes	\$1600
122	22	same	F, RW, FD	add-on	yes	\$3600
122 (2nd drive)	22	same	F, RW, FD	add-in	yes	\$2400
BMC If800 (C)	5	BMC If800-CP/M	F	built-in, add-in	yes	+ \$3000
B.T. ENTERPRISES 203505	5	TRS-80 I, III-DOS+ TRS-80 II, IBM Personal Computer	F	add-in	yes	\$2399
203510	10	same	F	add-in	yes	\$2549
203511	10R	same	F	add-in	yes	\$5000
CAMEO ELECTRONICS INC. 2005	5	Apple II-DOS, CP/M, Pascal NEC-CP/M; Xerox 820-CP/M IBM Personal Computer-DOS Commodore PET-DOS+; others	F, RW, RC	add-on	yes	\$2295
2005 (2nd drive)	5	same	F, RW, RC	add-on	yes	\$1495
2010	10	same	F, RW, RC	add-on	yes	\$2995
2010 (2nd drive)	10	same	F, RW, RC	add-on	yes	\$1995
DC 500	5 + 5R	same	F, RW, RC	add-on	yes	\$5995
1010	10R	same	F, RW, RC	add-on	yes	\$2995
1040	40	same	F, RW, RC	add-on	yes	\$6995
1020	20R	same	F, RW, RC	add-on	yes	\$8995
1050	40 + 10R	same	F, RW, RC	add-on	yes	\$9995
COMMODORE BUS. MACHINES D9060	5	Commodore IEEE models-with factory DOS	F	add-on	no	\$2995
D9090	7.5	same	F	add-on	no	\$3495

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

(continued on page 93)

HERE'S THE PERSONAL COMPUTER AD OUR COMPETITION DOESN'T WANT YOU TO READ.

It's an ad for NEC's APC™ Advanced Personal Computer. A solutions-oriented system that solves business problems in the simplest, most cost-effective way. The APC supports both CP/M-86™ and MS-DOS™. It can store more information than any system in its price range. In short, it's got the best price/performance of any personal computer. That's why our competition would prefer that you never see our system.

We asked some business men who sell systems why they chose us. The reasons were fairly uniform. They said the APC was the only personal computer on the market that gave you the power of a 6-bit microprocessor, a hard disk, a color display, a high-resolution graphics capability. For the price, the APC was the best value. These men said they were good

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"That APC of yours is the most powerful computer of any I saw. I don't know how you got it for that price."

"Now that I've used it for awhile, I see why you named it Advanced Personal Computer."

And that from businessmen who have tested the competition! When you see the APC, you'll understand why, at least, the others, all of these businessmen picked NEC.

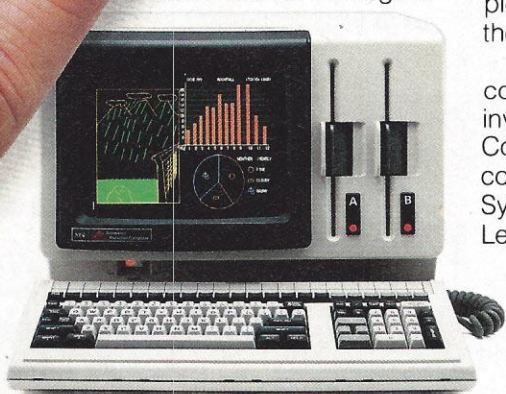
Our business software was optimized to take advantage of the APC's unique hardware features. That makes system operation faster and easier.

Our software includes a full set of general accounting packages, word processing, mailing list management, business planning, database management, and communications. And we're readying many more.

We're the only company to back our software with a unique conditional guarantee. It will work or you get your money back.

Smaller businesses use the APC as their principal data processing system. It handles everything from accounting and order processing to mailing list and management.

Larger companies use the APC for a decision support and communications tool for managers.



Name _____
Title _____
Company _____

compar... the APC
for plan... analysis,
data... manager... word
proc... As part... al
commu... work, t...
the Ar... al fo...
ronic m... ces...
comput... rietat...
datab...
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32... at...
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The...
models...

The mo...
combines a...
black high-res...
128K bytes of u...
a 1-million-byte f...
keyboard and ma...
dard features yo...
on competitiv...

Our high-resolution color graphics run circles, arcs and lines around everybody else. The APC's screen images—lines, characters, pictures—are unprecedented in their clarity.

See the personal computer our competition wishes had never been invented. The Advanced Personal Computer from NEC. Return the coupon to NEC Information Systems, Inc., 5 Militia Drive, Lexington, MA 02173.

APC is a trademark of Nippon Electric Co., Ltd.
CP/M-86 is a trademark of Digital Research, Inc.
MS-DOS is a trademark of Microsoft, Inc.

Send me more information on the
Advanced Personal Computer.

Address _____
City, State, Zip _____
Telephone _____

PLC 0183

NEC

NEC Information Systems, Inc.

5 Militia Drive, Lexington, MA 02173

The Benchmark in World Class Computers

Here's To

A close-up photograph of a hand holding a glass of champagne. The hand is wearing a gold-toned wristwatch with a metal link bracelet. The glass is filled with a bubbly liquid, and the background is dark with colorful confetti falling, creating a celebratory atmosphere.

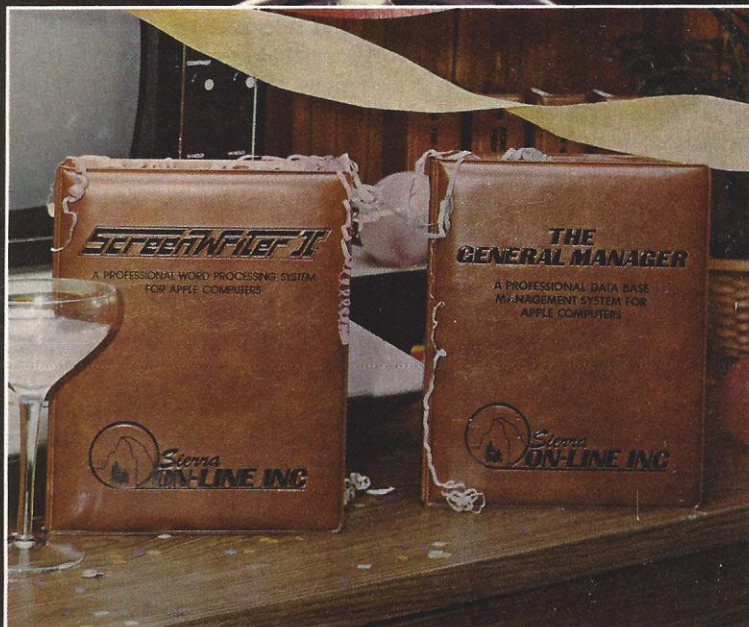
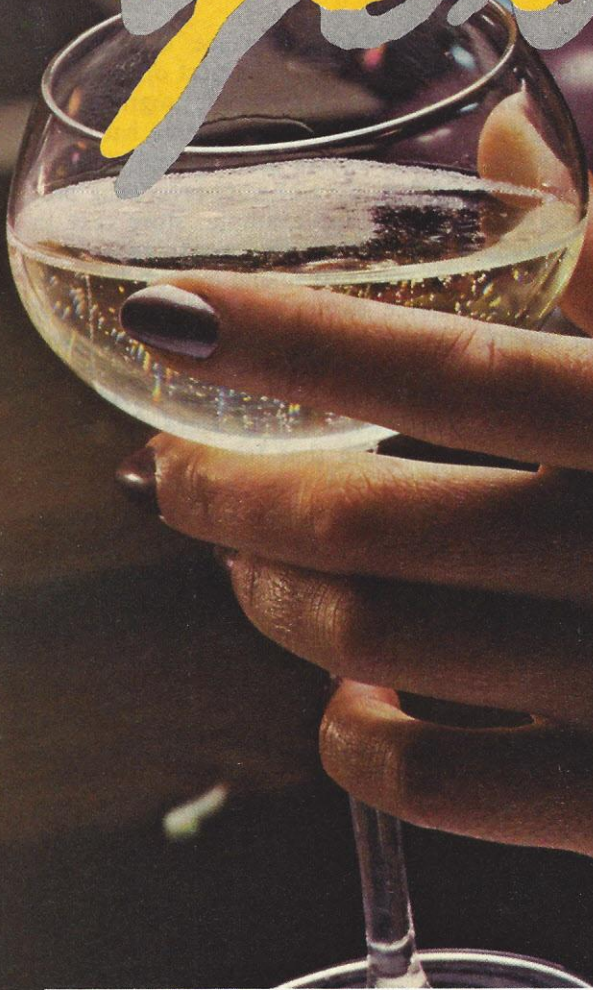
1982 The Year of Screenwriter II.

You did it! You - our dealers and customers - made Screenwriter II the No. 1 word processor of the year. For that we thank you! And rest assured, Sierra On-Line is continuing to create business products tailored to your needs. Just wait until . . .

1983 The Year of The General Manager

No personal filing system does more than The General Manager 2.0, and we'll be taking steps in 1983 to show you how easy it is to use. We made The General Manager flexible and powerful. You'll make it the No. 1 information manager of 1983.

you!



Thanks for your continued support
and have a happy 1983.

KEN WILLIAMS
Chairman of the Board
Sierra On-Line, Inc.

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TLX 910 362 5025 209 683 6858

HARD DISK DRIVES*(continued from page 87)*

save a 21-kbyte file to hard and floppy drives, using a personal computer and operating system. In this informal test, the floppy save took 31 seconds and the hard save took 13. This was a gain of 238 percent in actual use conditions. In other disk-intensive operations, and with different types of hardware and software, it could be even greater. You should expect to cut your disk-access times in half or better.

That might not seem like a great saving, because the time a system needs to execute a command is rarely long enough to let you begin another task. The time can build up, though, especially since searching through your floppies takes time, too. Add it all up, and the time you save could more than merit that \$2 a day.

Selecting a hard disk drive

Choosing the right Winchester for a computer system involves considerations like available capital, amount of storage needed, requirements of your particular computer, hard-disk packaging, type of service and support needed, and software needed. Each individual may weigh these factors differently, but they must be considered.

For most users, money comes first. Disk drives cost from \$1300 (for a kit) to over \$3000 for a 5-megabyte drive. This includes all the software and hardware needed to make it work with (or in) the computer of your choice. If you buy a computer with the drive built in, that drive will add \$1500 to \$3000 to the cost of the same machine with two floppy drives. The median figure for a five-megabyte drive is about \$2200. That price jumps to \$3000 for a 10-megabyte unit. The 10-megabyte drive is less than double the price of the 5-megabyte drive because its chassis, power supply, controller, interface and the like are similar to those of the 5-megabyte unit.

In general, the more you pay, the more you get. You pay extra for more storage capacity; similarly, a more versatile drive, like one with removable Winchester-like cartridges, will cost more. Other features that add to the selling price include a controller for a second drive (and maybe room in the chassis for one), built-in features like tape backup or an expansion chassis with slots for adding other peripheral devices, and extra quality shock absorption devices built into the chassis.

At the other end of the cost spectrum, the \$1295 Xebec kit deserves mention. It's a do-it-yourself, hard-disk kit, but it's not just for hobbyists. You don't need to solder or program to install the kit; it just takes some careful drilling and screwdriver work to mount the drive in the blank cabinet provided.

Beyond price, there's storage to think about. Most buyers settle for 5 to 10 megabytes. If you think you might need more, you can pay a bit more for one of the more expandable units. If you don't know how much you need, totaling your present storage on floppies could help.

Storage gains

With some computers only one brand of drive will be available, so you get whatever storage that unit has. You have more latitude with the more common computers, of course. In certain cases, third-party manufacturers will broaden your options by providing an interface. Not many hard drives work with Zenith Z-89 computers, for instance, but Magnolia Microsystems (Seattle, Wash.) provides an adaptor for a Corvus drive.

Drives come three ways: add-on, in a separate box; add-in, or retrofitted; and, in some cases, built-in from the factory. Built-ins and add-ons take less space and look neater, but add-ons can be serviced separately and you don't lose the rest of the computer system. You can transfer an add-on to a new computer, too, if

the proper interface is available.

One intriguing aspect of installing hard disks is that some programs that were designed long before hard disk drives existed perform well with the drives. Several word-processing programs, for example, store text in "virtual memory," swapping portions of your text to and from disk as you move through a document. This makes it easy to create and store long documents, but the waiting occasioned by the frequent disk accesses can be maddening. Hard disk drives eliminate that frustration, because disk-access time becomes negligible and the programs are already set up to store large files.

Other areas of installation may seem less encouraging. Copy-protected software is an especially thorny problem. You can't just transfer a copy-protected program onto the hard disk. You can usually store the data files for copy-protected programs on the hard disk, though. Moreover, some surprising answers to this problem may be on the way. Apple reports that Quark Engineering (Denver, Colo.) has created a program called Catalyst that installs protected programs like Visicalc and Applewriter III on a ProFile hard disk and relocks them there, with the software makers' blessings. Catalyst also gives you a menu of all the software on your hard disk when you boot up—a convenience. More programs like this will be coming soon.

Physical installation of hard disks tends to be straightforward—though you may want to have the dealer do it to avoid any warranty problems. In fact, some makers require dealer installation. The average installation consists of unplugging the computer, opening the case (some need unscrewing), plugging in an interface card and connecting the drive's cable to it. Sometimes the floppy-drive connection needs to be switched around a bit. Then the system can be turned on, but not all at once. Winchesters

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(continued from page 88)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
COMPUTER DYNAMICS WIN-5	4.1 (8 in.)	IBM Personal Computer, OSBORNE, Xerox 820, S-100, STD, Big Board, Digital group	F, FD	add-on	no	\$1695
WIN-10	8.2 (8 in.)	same	F, FD	add-on	no	\$2295
WIN-15	12.3 (8 in.)	same	F, FD	add-on	no	\$2895
CORONA DATA SYSTEMS Starfire 5	5	Apple II-DOS, CP/M, Pascal	F	add-on	yes	\$2495
Starfire 10	10	same	F	add-on	yes	\$2995
Personal Hard Disk 5	5	IBM Personal Computer	F	add-in	no	\$1995
Personal Hard Disk 10	10	IBM Personal Computer	F	add-in	no	\$2495
CORVUS SYSTEMS INC. Model 6	5.7	Apple II-DOS, Pascal; Apple III-SOS; IBM Personal Computer MS DOS, Pascal; TRS-80 I, II, III-NEWDOS-80; Atari 800-DOS; Commodore PET, CBM-DOS; Xerox 820, 820-2, Zenith Z89, 90, NEC 8000, Osborne-CP/M; Corvus Concept-DOS	F, V	add-on	yes	\$2495
Model 11	12.1 (5 1/4 in.)	same	F, V	add-on	yes	\$3495
Model 20	18.4 (5 1/4 in.)	same	F, V	add-on	yes	\$4495
CROMEMCO INC. HDD-11	10	Cromemco Systems One, Two, Three, Z-2H	F, T	add-on built-in	yes	\$6995
HDD-5	5	same	F, T	add-on built-in	yes	\$3495
CYBERNETICS Cyberdrive	13.5	IBM Personal Computer	T	add-on	no	\$5750
Cyberdrive	27	IBM Personal Computer	T	add-on	no	\$8000
DATA TECHNOLOGY INDUSTRY Data Vault	5	Data Technology Associate-CP/M	F	add-on	no	\$2995
DAVONG SYSTEMS INC. DSI	5.2	Apple II-DOS, CP/M, Pascal; Apple III-SOS; IBM Personal Computer-DOS; Qunix	F, T	add-on	no	\$1995
DSI	10	same	F, T	add-on	no	\$2495
DSI	15	same	F, T	add-in	no	\$2995
DAYSTAR TECHNOLOGY INC. Daystar 1	5	Apple II-DOS; TRS-80 Model II-DOS; IBM Personal Computer- DOS; S-100-CP/M-80; Cromix, NEC 8000, Xerox 820, 820-2-CP/M; Commodore- DOS; Heath-Zenith-CP/M	F	add-on	no	\$2295
Daystar 4	10	same	F	add-on	no	\$2595
Daystar 6	20	same	F	add-on	no	\$3195
D-IBM2	5, 10, 20	IBM Personal Computer	F	add-on	no	\$2695 \$2995 \$3595

C—computer with hard disk in it.

+—surcharge (cost of hard disk built into computer).

SPECIAL REPORT

(continued)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
DIGITAL EQUIPMENT CORP. RD50	5	DEC Rainbow 100-CP/M 80, 86 DEC Decmate II-COS-310 Professional 350-UCSD, Pascal	F	add-on	yes	\$3700
Professional 350 (C)	5	Professional 350-UCSD, Pascal	F	built-in	yes	no additional cost
EAGLE COMPUTER INC. File 10	10	Eagle II, III, IV	F	add-on	no	\$2993
File 40	40	Eagle II, III, IV	F	add-on	no	not available
FORTUNE SYSTEMS CORP.	5	Fortune 32:16-DOS	F, T	add-on	yes	\$1995 (+ controller card)
	10	Fortune 32:16-DOS	F, T	add-on	yes	\$2995 (+ controller card)
	20	Fortune 32:16-DOS	F, T	add-on	yes	\$3995 (+ controller card)
GENIE COMPUTER CORP. 5F	5	Apple II-DOS, Pascal; Apple III-SOS; TRS-80 Model II- LDOS; IBM Personal Computer- DOS; S-100-CP/M	F, RW	add-on	no	\$2295
10F	10	same	F, RW	add-on	no	\$2595
15F	15	same	F, RW	add-on	no	\$2895
20F	20	same	F, RW	add-on	no	\$3195
5 + 5	5 + 5R	same	F, RW	add-on	no	\$3995
X5	5R	same	F, RW	add-on	no	\$2695
HEWLETT-PACKARD 9133	4.6	HP80, 100, 1000 desktop, 9800-DOS, CP/M-80	F	add-on	no	\$4975
9134	4.6	same	F	add-on	no	\$4560
9135	4.6	same	F	add-on	no	\$5575
9138	4.6	same	F	add-on	no	\$8610
INTERTEC DATA SYSTEMS DSS-10	10	Intertec Superbrain II, Compustar-CP/M-80	F	add-on	no	\$3995
IQ SYSTEMS Graymatter 5	5	Apple II-DOS, CP/M; IBM Personal Computer-DOS, CP/M-86; TRS-80 Model II, Osborne, Xerox 820, 820-2-CP/M	F	add-on	no	\$1895
Graymatter 10	10	same	F	add-on	no	\$2495
Graymatter 20	20	same	F	add-on	no	\$3695
KAY PRO Kaypro 5	5	Kaypro 5-CP/M	F	built-in	no	+ \$2200
LOBO DRIVES INT'L. 950 A	4.9	Apple II-DOS, CP/M; Lobo Max-80-LDOS, CP/M; NEC-CP/M	F	add-on	no	\$3633
950 M	4.8	same	F	add-on	no	\$2405
950 N	4.9	same	F	add-on	no	\$2675
1850 A	8.2	same	F	add-on	no	\$4459

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

THE DEMAND: Making microcomputers more useful in a diversified organization.



The Boeing Intelligent Terminal System (BITS) from Boeing Computer Services is a family of software products that integrates different types of microcomputers into a uniform system. BITS assures consistency of operation and uniformity of output for a variety of microcomputers you currently use or plan on using. It allows you to perform many functions on a variety of hardware utilizing one simple and standard interface. BITS also provides communication flexibility by permitting individual microcomputers to be used as intelligent data entry devices to a host computer or by facilitating micro-to-micro communications.

A step into distributed processing.

BITS converts all your microcomputers into true distributed processing worksta-

tions. You can perform a wide range of stand-alone applications or utilize the increased power and capacity of a mainframe as you require. The mainframe can be your own or a remote computing service like BCS' MAINSTREAM®.

BITS protects your investment.

With microcomputer prices coming into such a widely affordable range, your biggest long-term investment may very well be applications software. All BITS programs are compatible among various microcomputers so there is no re-programming and — most important — there is no re-training of personnel. You can even add new hardware as individual users may prefer. BITS will keep you up-to-date with the latest technology — compatibly and economically.

BITS gives you *proven* productivity and support. This innovative concept has been in use within The Boeing Company for three years. The productivity increases using BITS were carefully tracked. In one case, BITS saved ten dollars for every dollar invested.

And like all BCS products, BITS is supported by over 6,500 professionals providing a wide variety of data processing packages and services to a broad base of technical, commercial and government customers.

Learn more. Write or call your local BCS office or:
Mr. Sidney W. Kraft
Boeing Computer Services Company
7980 Gallows Court
Vienna, VA 22180

BCS

BOEING COMPUTER SERVICES COMPANY

A Division of The Boeing Company

THE ANSWER: The Boeing Intelligent Terminal System (BITS) from Boeing Computer Services.



BITS

I'm interested in learning more about BITS.

- Send me: ☐ Folder: "With more than one microcomputer you need BITS."
☐ Folder: "An introduction to Boeing Computer Services."
☐ Have a BCS representative call for an appointment.

Name _____ Phone _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

CIRCLE 30

SPECIAL REPORT

(continued)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
1850 M	8.0	same	F	add-on	no	\$3085
1850 N	8.2	same	F	add-on	no	\$3459
MAEZON V-5000	5	Apple II-DOS, CP/M, Pascal; TRS-80 Model III-DOS; S-100-CP/M	F	add-on	yes	\$1995
V-10000	10	same	F	add-on	yes	\$2295
V-15000	15	same	F	add-on	yes	\$3295
M/A-COM OSI 220 E (C)	7	220E-OS-65 U; 230 E, I-OS-65 U, CP/M	F	built-in	yes	+ \$4640
230 E (C)	7	same	F	built-in	yes	+ \$3610
230 I (C)	40	same	F	built-in	yes	+ \$7085
MICROCOMPUTERS OF NEW ORLEANS Helix Subsystem	5	Apple II-DOS, CP/M, Pascal; IBM Personal Computer-CP/M-86; Osborne, Kaypro, Xerox 820, North Star, Morrow Micro Decision-CP/M	F	add-on	no	\$2500
Helix Subsystem	10	same	F	add-on	no	\$2800
Helix Subsystem	15	same	F	add-on	no	\$3000
MORROW DESIGNS Decision 1 (C)	5	IEEE696 S-100-CP/M; Micronix; Oasis	F	built-in	no	+ \$1800
Add-on	5	same	F	add-on	no	\$2195
Add-on	10	same	F	add-on	no	\$2795
Add-on	16	same	F	add-on	no	\$3495
MOUNTAIN COMPUTER INC. Dynamic Disk System	5	Apple II-DOS, CP/M, Pascal; Apple III-SOS; IBM Personal Computer- DOS, CP/M-86	F	add-on	no	\$2295-\$2695
Dynamic Disk System	10	same	F	add-on	no	\$2995-\$3395
Dynamic Disk System	15	same	F	add-on	no	\$3445-\$3995
NEC INFORMATION SYSTEMS APC-H	4.5	NEC APC-CP/M-86	F	add-on	no	\$2200
APC-H	9	same	F	add-on	no	\$2800
NETRONICS R&D LTD. Auto-Patch-6	5	S-100-CP/M	F, RW	add-on	no	\$2995
Auto-Patch-6 (2nd drive)	5	same	F, RW	add-on	no	\$1995
Auto-Patch-12	10	same	F, RW	add-on	no	\$3495
Auto-Patch-12 (2nd drive)	10	same	F, RW	add-on	no	\$2495
NORTH STAR COMPUTERS Advantage, Horizon (C)	5	North Star Horizon-CP/M, TSS/A, HDOS North Star Advantage-CP/M, MS DOS, HDOS	F, T	built-in	yes	+\$1400

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

THE LEMONTM SOURS SURGES



Our crop-The LemonTM, The LimeTM, and The OrangeTM are designed to eliminate undetected submicrosecond overvoltage transients from electrical circuits. Commonly referred to as "spikes", or "glitches", these transients can cause hardware and software damage to unprotected circuits.

Today's electronic products are often microprocessor controlled - mini and micro computers, televisions, video cassette recorders - to name a few. Each of these products is sensitive to fluctuations in electrical power lines. Power switching devices such as refrigerators coming on and off or air conditioners starting up can be responsible for a momentary surge or spike of electricity in a circuit. Even your local

utility stepping-up transformers to add power at peak load times or an electrical storm passing through can trigger surges. Such surges can cause equipment to falter at times, not to work at peak performance or fail completely. An entire data base can be lost.

Now you can prevent this from happening to you with an AC Surge Protector from Electronic Protection Devices. Each Protector is a solid state clamping device with 6 outlets utilizing modern high speed semiconductor technology. Using our Protectors is as simple as plugging it into any standard three wire duplex outlet then plugging what needs protection into it. Each Protector exceeds the IEEE 587-1980 Guide for Surge Voltages in Low

Voltage AC Power Circuits.

When you compare the cost of computer hardware, software and your time with the price of a Protector (from \$59.95 to \$139.95), you'll want to sour your surges with one of the AC Surge Protectors from EPD, which are available through your local dealer.

Electronic Protection Devices

5 Central Avenue
Waltham, Massachusetts 02154

In Massachusetts Call:
(617) 891-6602

Outside Massachusetts Call:
1-800-343-1813

Dealer Inquiries Invited

SPECIAL REPORT

(continued)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
HD 5	5	same	F, T	add-in	yes	\$2399
HD 15	15	same	F, T	add-in	yes	\$3500
HD 18	18	North Star Horizon	F, T	add-on	yes	\$5374
Advantage, Horizon (C)	15	North Star Advantage, Horizon	F, T	built-in	yes	+ \$2500
OLIVETTI CORPORATION HDS 1053	8.8	Olivetti M20, M30, M40- PCOS, MS DOS, CP/M-86	F	built-in, add-in, add-on	no	\$3782
Personal Computer ² Disk-6	5	IBM Personal Computer-MS DOS	F	add-on (+\$50-\$100), add-in	no	\$1895
Disk-12	10	same	F	same	no	\$2195
Disk-18	15.5	same	F	same	no	\$2695
PERCOM DATA CORP. PHD 5	5	TRS-80 Model III-DOS PLUS Apple II-DOS IBM Personal Computer-CP/M-86, MSDOS	F	add-on	no	\$2295-\$2450
PHD 10	10	same	F	add-on	no	\$2795-\$2950
QANTEX-NO. ATLANTIC Model 150 (backup unit)	not applicable	S-100-CP/M, MP/M	T	add-on	no	\$1925
QUALITY COMPUTER SERVICES DSK-51	5	Apple II-CP/M; TRS-80 Model III-LDOS, DOS+, CP/M; TRS-80 Model III- CP/M, TRS-DOS, Oasis, TurboDOS; IBM Personal Computer- DOS, UCSD, Pascal, CP/M-86; NEC 8000, Altos, North Star, Intertec, Heath-Zenith, Epson, Panasonic, Osborne- CP/M; S-100	F, RW	add-on	yes	\$2599
DSK-52	10	same	F, RW	add-on	yes	\$3000
DSK-53	16	same	F, RW	add-on	yes	\$3500
DSK	32	same	F, RW	add-on	yes	\$5000
DSK-70	35 + 5R	same	F, RW	add-on	yes	not available
RADIO SHACK 26-1130	5	TRS-80 Models I, III-DOS	F	add-on	no	\$2495 (+ \$40 for Model I)
26-1130 (2nd drive)	5	same	F	add-on	no	\$1995
26-4150	8.6	TRS-80 Model II, 16-DOS	F	add-on	no	\$4495
26-4151 (2nd drive)	8.9	same	F	add-on	no	\$3495
SANTA CLARA SYSTEMS Hobbyist-5	5	Apple II-DOS, CP/M, Pascal; TRS-80 Model III-DOS, Oasis; IBM Personal Computer-DOS, CP/M-86	F, T, RW	built-in	yes	\$1995
SCS-5	5	All of above plus Apple III- SOS; TRS-80 Model II-DOS, Oasis, S-100-CP/M; Altos; Cromemco; Osborne-CP/M	F, T, RW	built-in	yes	\$3495
SCS-510-F	10	same	F, T, RW	built-in	yes	\$4756

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

(continued on page 102)

THE PEACH™ WITHOUT FUZZ



The Peach™ is the newest addition to Electronic Protection Devices' crop of EMI/RFI Filters/AC Surge Protectors. It eliminates transients such as "spikes" or "glitches" same as The Lemon™, The Lime™ and The Orange™ while simultaneously filtering out "fuzz" or "noise" produced by Electro Magnetic Interference (EMI) or Radio Frequency Interference (RFI).

The increasing complexity and scope of modern electronics demands that each microprocessor controlled product perform its function without extraneous signals of any kind that would degrade or reduce the intelligibility of that product. "Hash" - electrical noise from rapid opening and closing of contacts or

"glitches" - random noise pulses that produce small disturbances in the baseline of your CRT display interfere with normal operation by causing errors in data transmission. Data errors can lead to skewed results, lost time and aggravation.

Prevent this from happening to you with The Peach. Each Peach is a solid state clamping device with EMI/RFI filtering utilizing high speed semiconductor technology. Simply plug The Peach into any standard 3 wire duplex outlet then plug what needs protection into it. Each Peach has 3 outlets and exceeds the IEEE 587-1980 Guide for Surge Voltages in Low Voltage Power Circuits.

Compare the cost of computer hardware, software and your time with the price of our Peach (\$97.50). You'll opt for a line free from surges and no fuzz with The Peach from EPD. Available through your local dealer.

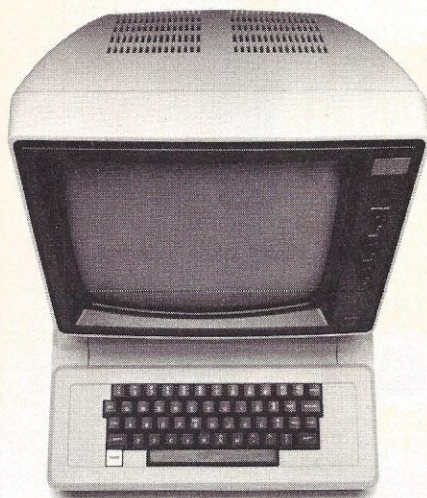


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1-800-343-1813

IF YOU'RE CONFUSED PERSONAL COMPUTER,

At this moment, there are no less than 50 personal computers on the market. And more are being introduced every day.

On one hand, having all those options is a good thing. On the other, it can make picking the right one pretty difficult.



*Computers come in two parts.
You have to buy both.*

We'd like to help. So here are a few suggestions about how to buy the computer that's right for you.

Computers come in two parts.

One part is the "hardware," which is the machinery itself. The other is the "software," or a program, as it's sometimes called.

Software is the part that tells the computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything.

And vice versa.

You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember, it's the software that knows how to get things done), it makes good sense to pick the software first.

Start by making a list of the things you want to use the computer for. It can include almost anything—any kind of inventory, filing, accounting, graphics, reporting, record-keeping, analysis—you name it and there's probably a software program that does it.

Next, take the list into a computer store and ask the salesperson to give you a demonstration of the program, or programs, that will do the things you want.

Even though you'll need a computer for the software demonstra-

tion, keep in mind the computer is just a vehicle. The software is the driver. And once you've decided on the software, picking out the rest of the computer system will be much easier.

The simpler the better.

Look for software that's easy to learn, easy to use, and that does the job in the simplest way possible.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you have to do without getting in the way.



Meaning there are no complicated routines to follow to perform a simple task. And no programming language to learn.

Some people, however, will tell you that software has to be complicated to be powerful.

Nothing could be farther from the truth.

Because in order for a program to appear simple to you on the outside, it has to be extremely complex on the inside.

ABOUT BUYING A HERE'S SOME HELP.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

You simply have to see for yourself.

You can read any number of interesting books and magazines about personal computers. You can ask friends who have them. You can look at all the sales literature you can get your hands on. And you should do all those things before you decide to buy.

But as helpful as all that can be, there really is no substitute for a real, live demonstration.

When you do go out shopping, we recommend you take a look at the PFS® Family of Software.

The PFS family is designed the way we think all software should be: simple, straightforward and powerful.

Currently, three products make up the family. PFS:FILE, PFS:REPORT and PFS:GRAPH, with more programs on the way. Here's a little more about each of them.

PFS:FILE. The simplest way to get organized.

Basically, FILE works like a paper filing system, without the paper. So you can record, file, retrieve and review information in a fraction of the time it takes with a conventional filing system.

FILE lets you arrange your information in "forms" you design yourself. So you can get at and really use your information in ways never before possible.

What's more, FILE lets you change the original form without having to redo the information on it.

PFS:REPORT. Making the most of your information.

REPORT summarizes the information on your forms so you can use it to analyze, plan and make better-informed decisions.

With REPORT, you get presentation-quality reports—sorted, calculated, formatted and printed—automatically, in seconds.

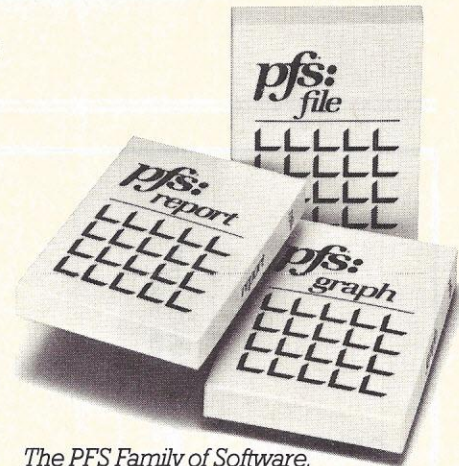
PFS:GRAPH. Instant pictures.

GRAPH gives you presentation quality bar charts, line graphs, and pie charts, in black and white or color, on paper or the computer screen. To get a clearer picture of things and spot trends instantly, you simply enter your information and specify the kind of graph or chart you want. GRAPH does the rest.

You can also mix and match line and bar graphs, or even stack or compare up to four bar graphs simultaneously.

And GRAPH will work with PFS:FILE, VisiCalc® files, or data entered directly into the computer.

Best of all, compared to the cost of hand-drawn graphics, GRAPH can save you enough money over the course of a few months to pay for the computer it runs on.



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Now we're making them simpler to buy.

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SPECIAL REPORT

(continued from page 98)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED F (Floppy disk) T (Tape cartridge) V (Video tape) RW (Removable Winchester) RC (Removable cartridge disk) FD (Fixed drive)	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
SCS-10-R	10.6R	same	F, T, RW	built-in	yes	\$7310
SCS-5R	5R	same	F, T, RW	built-in	yes	\$2500
SCS-40	40	same	F, T, RW	built-in	yes	\$8707
SCS-120	120	same	F, T, RW	built-in	yes	\$14,440
SEATTLE COMPUTER Gazelle (C)	15	Gazelle-MS DOS	F	built-in or add-in	no	+ \$2500
SONY CORPORATION 6 SNY	5.9	Sony SMC-70-CP/M-80	F	add-on	no	\$2795
11 SNY	10.5	same	F	add-on	no	\$3495
20 SNY	18.4	same	F	add-on	no	\$4495
TALLGRASS TECHNOLOGIES TG-3006	6.25	IBM Personal Computer-DOS, CP/M-86, MS DOS, Telesoft ADA, Coherent UCSD P-System	T	add-on	no	\$4495
TG-3012	12.5	same	T	add-on	no	\$4895
TECMAR INC. Winchester 5	5	IBM Personal Computer-DOS, CP/M-86	F	add-on, add-in	yes	\$2995
Winchester 10	10	same	F	add-on, add-in	yes	\$3995
Winny/5R	5	same	F	add-on, add-in	yes	\$1795
TARBELL ELECTRONICS HDS-10	10	S-100-CP/M, MP/M	F	add-on	no	\$4515
HDS-33	33	same	F	add-on	no	\$5200
HDS-66	66	same	F	add-on	no	\$6650
HDS-5	5	same	F	add-on	no	\$2000
TELEVIDEO TS 802H (C)	5	TeleVideo TS 802H- CP/M	F	built-in add-in (+\$300)	no	+ \$2500
THOUGHT WORKS INC. Data File HD05	5	Apple II-DOS, CP/M, Pascal; TRS-80 Model III-LDOS; Xerox 820 & 820-2-CP/M; Sanyo MBC 1000 & 3000	F	add-on	no	\$2495
Data File HD10	10	same	F	add-on	no	\$2995
Data File HD16	16	same	F	add-on	no	\$3795
Data File HD20	20	same	F	add-on	no	\$4495
TOSHIBA AMERICA T 250 (C)	5	Toshiba T 250-CP/M	F	built-in add-in (+\$600)	no	+ \$3000
TRANOR SYSTEMS LTD. TSL-5	5	Osborne-CP/M	F	add-on	no	\$2995
TSL-10	10	same	F	add-on	no	\$3395
TSL-15	15	same	F	add-on	no	\$3995

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

The DSI-A506 provides 5 MB formatted (6MB unformatted) storage for only \$1995. The DSI-A512 provides 10 MB formatted (12 MB unformatted) storage for just \$2495.* And the DSI-A519 provides 15 MB formatted (19 unformatted) for \$2995.*



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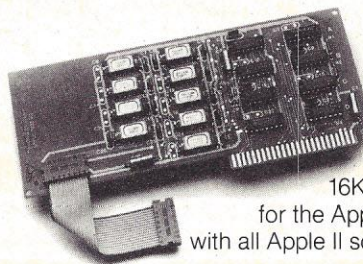
Supports Apple DOS 3.3®, Apple Pascal®, and CP/M®. Intermixed. You can even allocate storage for all three systems on one hard disk, and transfer files easily from one system area to another. The Davong system reformats the transferred file automatically.

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SPECIAL REPORT

(continued)

FEATURES OF HARD DISK DRIVES

COMPANY/ MODEL	FORMATTED CAPACITY (MB) (R = removable disk)	COMPUTERS AND OPERATING SYSTEMS IT WORKS WITH	FORM OF BACKUP PROVIDED (Floppy disk) F (Tape cartridge) T (Video tape) V (Removable Winchester) RW (Removable cartridge disk) RC (Fixed drive) FD	CONFIGURATION Add-on Add-in Built-in	NETWORK AVAILABLE	PRICE
UNITED PERIPHERALS 9800	4.6	HP 80, 100, 9800-CP/M	F	add-on	no	\$2995
VECTOR GRAPHIC INC. Vector 430 (C)	5	Vector Graphic-CP/M	F	built-in, add-on, add-in	no	\$5995
Mini-Star	5	same	F	same	no	\$5195
Mega-Star	32	same	F	same	no	\$10,195
VICTOR BUSINESS PRODUCTS 6310	10	Victor 9000-MS DOS, CP/M-86	F	add-on	no	\$4495
VISTA COMPUTER CO. VI 200 (floppy cartridge system)	6	Apple II, Franklin, Basis 108- DOS, CP/M, Pascal	not applicable	add-on	no	\$1549
VR DATA	5	TRS-80 Model I, III-DOS+; TRS-80 Model II, IBM Personal Computer-DOS	F, FD	add-on	no	\$1899
	10	same	F, FD	add-on	no	\$2899
	10	same	F, FD	add-on	no	\$2099
	20	same	F, FD	add-on	no	\$3199
	15	same	F, FD	add-on	no	\$2399
	30	same	F, FD	add-on	no	\$3599
WANG LABORATORIES Personal Computer PM-021	5	Wang Prof. Computer- MS DOS, CP/M	F	built-in	yes	\$3500
WICAT SYSTEMS 150WS (C)	10	Wicat 150WS, MCS, Unix, CP/M emulator	F	built-in	no	\$9450
XCOMP PHD 4x4	8	Apple II-DOS, CP/M, Pascal; Apple III-SOS; IBM Personal Computer-MS DOS; NEC 8000- CP/M; BMC if800-CP/M	F	add-on	yes	\$2195
XEBEC (UNITED PERIPHERALS) Xebec Kit	5	Apple II-DOS, CP/M, Pascal; IBM Personal Computer- DOS, CP/M-86	F	add-on	no	\$1295
XEROX CORPORATION Rigid Disk Drive	8.2	Xerox 820-2-CP/M	F	add-on	yes	\$5450
XITEN SYSTEMS Gallium-10	11.3	Apple II-DOS, Pascal, CP/M IBM Personal Computer-DOS	F	add-on	yes	\$2495
ZENITH DATA SYSTEMS Z 67	9.8	Zenith Z90, Z89-CP/M; IBM Personal Computer	F	add-on	no	\$5995

C—computer with hard disk in it.
+—surcharge (cost of hard disk built into computer).

(continued on page 178)



January 1983 PERSONAL COMPUTING 105

A Fluid Well For Your Words

Word-processing programs are more than efficient productivity tools. They also let writers tap deeper into their wellsprings of creativity

by G. Berton Latamore

Novelist Ernest Hebert's initial experience with word processors came just after his first book, *Dogs of March*, was published in 1979. At that time the newspaper he worked for, *The Keene Evening Sentinel*, in Keene, N.H., bought a Compu-graphic word-processing system. That experience had the impact on him of suddenly falling in love.

"After working on the word processor for 20 minutes, I knew it was going to change my life," he said later. "Once I learned it could do the two essential things a writer really needs—insert and delete—I knew I'd finally moved from the Stone Age to the Space Age."

In the fairy tale world, this story would end quickly with, "He ran out and bought a personal computer, and the writer and the computer lived happily ever after." In the real world, this first experience was the start of a four-year struggle during which Hebert bought, and sold, first a TRS-80 Microcomputer Model I, then an IBM memory typewriter before settling down with his present TRS-80 Model III. On the way, he has developed insight into both the strengths and weaknesses of computers and their relationship to the creative process.

Hebert's writing method makes

G. Berton Latamore is a free-lance writer who lives in Providence, Rhode Island.

him an almost perfect user of word processing. It is doubtful that Jack Kerouac, who never even reread his first drafts much less rewrote them, would find a computer of much value. Hebert, on the other hand, says, "I'm not a writer, I'm a rewriter. I can't write anything first draft."

Philosophical doubts

The author, however, had philosophical doubts about using computers in the process of creative or artistic writing. He doesn't think it's disconcerting to dash off news stories on a word processor, though. "Writing a news story is so formulaic that, in many ways, it becomes a simple Pavlovian response to a set of facts." But fiction, Hebert feels, is more complex and requires putting in motion a much wider range of subtle aesthetic and artistic considerations. He says he questioned for a long time whether high technology should, or could, be used to craft literature describing idyllic New Hampshire life. He had composed *Dogs of March* in the mid-1970s, as well as two unpublished novels that preceded it, on an Underwood manual typewriter he inherited from an uncle who died in 1956. It was a long step from that to a computer.

"Think of Henry David Thoreau hiking to Walden Pond with a VDT strapped to his back and a 2000-foot extension cord," Hebert says. "That would be blasphemy to any natural-

ist. Of course, today it's becoming less difficult to do—Thoreau would probably have an Osborne."

Despite his reservations, Hebert found that his exposure to word processing at the newspaper was undermining his ability to come home and write on his typewriter, which was slow and had no editing capability. After the publication of *Dogs of March*, he worked several months on a book, but in frustration he decided to throw it out. He came to a standstill; he began to realize he could no longer write without a computer.

About the time he was wrestling with this, Hebert received a pleasant surprise. A long while back, a friend had convinced him to apply for a federal National Endowment for the Arts grant. When he finally received a check from the agency, it came as a total shock. He had forgotten he applied for it. With the found money, he decided to buy a computer.

The computer-selection adventure

This decision started him on an adventure in computer selection. He first made up his mind to buy a system locally, even though the magazine mail-order ads promised lower prices. He fully expected to have problems with his new machine. By buying from a local store, he hoped to ensure a source of help and advice. However, he discovered that in 1979 there were very few computer stores in New Hampshire. What's more, the

The New England novelist questioned for a long time whether high technology should or could be used to craft literature describing idyllic New Hampshire life. But his fears were unfounded.

Going from the uneditable typewriter to the word processor seemed to unleash his creative talent. His fingers flowed across the keyboard. Word processing makes changing your words and thoughts so much easier. It provides...

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You'll also be delighted with Discourse[™]. A spooler that saves you a lot of time. Because it lets you use your computer while you're printing other reports. Plus, you can queue up to 14 documents. The price is \$125.

And if you need an automated appointment calendar, the answer is Quark's new Vigil[™]. No matter what your Apple III is doing, Vigil will alert you to the next event on your busy schedule. The price is attention-getting, too. Just \$95.

Your dealer wants to show you these exciting new programs today. And while you're there, be sure to ask for our free brochure: Apple Polishing.

Or write us directly.

You'll discover how to put Quark's unique line of software to work for you. And then your Apple III can really shine.

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The computer seemed to unleash his talent. It certainly made the writing process easier and faster.

salespeople he dealt with at existing stores all seemed new to computers themselves. Either they talked a completely incomprehensible language, which reminded him of the medicine show faith healers that used to come through town, or they had set sales pitches about their products that didn't vary, another sure sign of ignorance, he thought. Still he pressed on and, despite his feeling that he was locked in a blind-leading-the-blind situation, he felt he learned at least a little bit during the course of these conversations with retailers.

Because his initial reason for buying a computer was for word processing, Hebert considered getting a dedicated word processor. He talked to salesmen from Lanier and Wang about their machines. He found the hardware much too expensive and the salesmen interested only in discussing their products with office managers ready to order several systems.

For the perfectionist

What Hebert really wanted was a computer and a simple word-processing program that would enable him to edit and write copy quickly, without any sophisticated mailing or formatting functions—the stripped-down Yankee model, as he terms it. What he found out was that most word-processing programs for personal computers were trying to emulate the more powerful dedicated word processors, and in so doing, he thought, they tended to confuse neophyte computer users. Hebert finally found a local Radio Shack manager who recognized him as an unrecalcitrant, simple-is-beautiful buff and advised him to buy the TRS-80 Model I and Scripsit, Radio Shack's basic word-processing software program. He took the package home and started what would become his second published novel, *A Little More Than Kin*.

The computer seemed to unleash his talent; it certainly made the writing process much easier and faster.

SOME PRACTICAL TIPS FOR PROCESSING YOUR WORDS

Are you feeling overwhelmed by the amount of information you must absorb and the complexity of buying a computer and word-processing program? Here are some tips designed to help you:

- Read computer magazines, especially the ads. This will help you understand some basic issues and master some of the vocabulary you will need to talk to computer salesmen. Ernest Hebert discovered that ads often tip you off to important issues. For example, if a computer is advertised as having a green screen to reduce eyestrain, you immediately know eyestrain can be a problem.
- Find someone in the world of computers to talk to and listen to what he says. Even if he's off base in regard to your application, you'll be learning.
- Define your needs before picking a system. For instance, you may find that a system that is good for one use may be nearly useless for another.
- Select hardware and software according to your application. Technical considerations, such as whether you buy an 8- or a 16-bit computer, or a first or second generation one, don't really matter. What matters is that the hardware and software do what you need them to do.
- Make sure the hardware you buy will support the software you want. It's a good idea to review word-processing packages to see which programs work with which operating systems. It would be a shame to buy hardware and then find that the software you want will not run on it.
- Practice with the program before you buy. Consider whether the control keys are positioned well, and decide if the program provides enough functions. Do you have insert and delete? Is the insert capability infinite or limited? Do the control keys impede proofreading? Does the program include hyphenation and justification, and do you need those functions? Are you comfortable using the program?
- Look for a HELP function that you can call up when you're confused.

Some systems guide you through the system while you're working with it.

- Be sure the documentation is readable and doesn't assume that you know what you're doing. If information about loading the machine isn't up front, the documentation writers might think you know how to begin. See if there are a table of contents and an index—essential to good documentation—and check to see that the basics are covered.

- Consider your computer's environment. Is there a clean space for it, since dust can shorten a computer's life? Are the lights adjusted for minimum glare on the screen, or do you want a fresnel coating to cut down reflection?

- Do you want a portable computer? Portable computers are generally much less capable than their larger personal cousins that are designed to stay in one place. But if you're going to be on the road a lot, or if you want to take the computer to your writer's retreat like Hebert did, you may want to consider a portable.

- Stay away from color terminals. The problem with them is that the colors are created by overlaying three primary colors, each created by a different electron "gun." If the colors get even slightly out of synch, and they invariably do, the result is blurred or double-image letters. At the very least, be sure to get a demonstration of how the text looks on a color background before you buy—but keep in mind that however perfect it may appear at a given moment, the situation can soon change.

- Insist on a demonstration of the program in an 80-column mode to test readability of the smallest text sizes.

Armed with these tips, the process of buying a computer and word-processing software should be a breeze. Right?

No matter how intimidated you may feel, remember that others preceded you and others will follow. It's not always easy to be on the crest of the wave of the future.

“Think of Henry David Thoreau hiking to Walden Pond with a VDT strapped to his back and a 2000-foot extension cord.”

Originally a poet who studied at Stanford University Writing Center, Hebert writes fiction the way Robert Frost wrote poetry—line by line and slowly. At the Breadloaf Writer's Conference in Vermont, he studied under the late novelist John Gardner, who taught him to revise and rewrite constantly. Hebert writes a scene at a time and reworks each scene several times before going on to the next. His new word-processing program allowed him to continue his naturally perfectionistic writing style, because he could edit and re-edit copy with ease, without retyping entire sections of the novel. At the same time, the computer measurably sped up his pace, because his fingers flowed across the keyboard.

The difference was telling. When he wrote *Dogs of March* on the typewriter, he was able to finish one page a day, and the entire novel took him three years, or 1728 hours, to complete. On the other hand, *A Little More Than Kin*, written mainly on the computer, took him only one year, or 480 hours, to finish—and he was able to compose four pages a day.

“I couldn't believe I was writing so fast,” Hebert says. “It seemed wrong.” Indeed, he became concerned that he might be writing too fast. “You can get going with such speed that the thought you are following doesn't have a chance to mature in the mind as it will if you are working on the same thought for a week. And sometimes a thought that is put down on paper too quickly loses its potential richness. So, using the computer, I do have to force myself to slow down.”

Unfortunately, Hebert's reliance on the computer also brought on a modern-day occupational hazard of the writing profession. Because he was staring into a CRT as a news editor on *The Sentinel* during the day and writing a novel plus a column for *The Boston Sunday Globe* on a computer at home at night, he developed computer-monitor burnout. “It

was like watching television 14 hours a day,” he says.

He came down with an inflammation in his eyes and even a nervous twitch. So, reluctantly, he sold his computer and replaced it with an IBM 75 memory typewriter, which allowed him to edit a page in memory and print out a clean copy automatically. It cured his eye problems, but although he still could edit copy on the IBM typewriter, he lost a good deal of the speed that the computer keyboard offered him. What's more, the typewriter was a delicate machine that continually broke down. He became saddled with a service contract that cost \$275 a year.

When he sold *A Little More Than Kin* in 1981, Hebert left *The Sentinel* on the strength of the royalty advance that his publishing house gave him, and he started writing fiction full time. He soon realized that he missed the computer.

A second-generation buyer

Hebert then went back to talk to his local computer retailer about another Radio Shack machine, mainly because he liked Scripsit, even though more advanced program alternatives were available by this time. He had liked Scripsit from the first, and while it didn't offer some of the sophisticated features of its competitors, it gave him what he needed—insert and delete capabilities. In fact, he decided to take his simple-is-beautiful attitude one step further and eliminate the use of disk drives—almost a heretical notion in personal computing's current era. He says disk drives were just other pieces of machinery; more parts that could break down. Scripsit remained suitable, since it is one of the few software programs still available on cassette tape. So in August, he sold his typewriter and bought a TRS-80 Model III.

Hebert is clearly not your average computer or word-processor user. Because he has eschewed the disk

drive, he does not store his writing electronically. Instead, he turns his computer on in the morning and loads Scripsit before breakfast. And at night, after writing and polishing a scene, he prints his finished work on a C.Itoh dot-matrix printer and then shuts the machine down.


While he's totally satisfied with this method, most other word-processing software users will advise you to save the material you write every half hour or so onto a disk, lest you lose your work in a power outage.

Hebert finds that his computer does have two drawbacks. For one, he misses the typewriter and the thrill of seeing words appear on paper under his fingertips. Recently he bought a portable typewriter, and occasionally he types a letter.

More important, the computer ties him to his tiny upstairs workroom. He can't take it on trips or up to his weekend cabin, which he always thought of as his writing retreat. To bypass this limitation, he is considering buying an Osborne.

“When I'm between writing projects, I start thinking about what equipment I could buy to help my writing,” Hebert says.

The computer is much more than a high-tech typewriter to Hebert. It is an active part of his creative process. Still he has a nagging notion that he hasn't yet figured out how to use it to his utmost aesthetic advantage.

“I get the feeling that there is something in these personal computers that some writer a generation from now will uncover that will give us a new Shakespeare,” he says. “Word processing makes changing your words and thoughts so much easier. It lets you tap deeper into the wellspring of creativity every writer has. There is a metaphor in word processing that somehow describes a very essential element of true participation in the creative process: The cursor is your pointer, yet you can never catch it. It always stays one step ahead of you.” 

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Computing Your Family Tree

The modern craze of tracing family histories has become another application for the personal computer. And the question is whether word-processing or data-base management software is best for the budding genealogist

by Rita Parker

Genealogy is the third largest hobby in the United States. Spurred on by both Alex Haley's *Roots* and the American bicentennial, people from all over the country are tracing their histories—and some are doing it with the help of personal computers.

According to David Dearborn, reference librarian for the New England Historical Genealogical Society in Boston, "It's really at the grass-roots level. People in every economic and social spectrum are involved—in every state. We're getting away from the stereotype of the old maiden lady with the bun tracing her family tree. Many business people, housewives and college students are involved. I even get 12-year-old kids in the library who want to trace their histories."

One couple who became interested in genealogy long before the current craze is Paul and Sara Andereck. Thirty years ago, as newlyweds with two little babies, they were at that point in their lives when the future was rosy and promising and the past was, well, the past. They were busy

attending to the needs of a young and vital family, patterning their existence on the families that had gone before them.

Their newly purchased family Bible contained a family tree, and the Anderecks wanted to fill it out for their children. But they were surprised at how little they knew about their heritages—there was more tree than they could fill in.

The couple became intrigued and started to ask questions of older family members. Before long, they were addicted to tracing their family roots. What originally started as an exercise in planning for the future became a lifelong examination of the past.

Thirty years ago Paul Andereck didn't know his family history beyond his grandfather; today he knows his family saga back to 1488 in Switzerland. And now he spends his days helping other family historians trace their lineages and record their data on personal computers.

David Dearborn reports that 90 percent of the genealogists in this country are people who get started in much the same way Andereck did—with a simple interest in tracing their ancestors. Some do it for social reasons. They may want to prove they're

blue bloods. Or they want to join an organization such as the Daughters of the American Revolution, which requires proof of lineage. Others want to belong to the Mayflower Society or to prove that they're descendants of the "colonial barons of Runnymede." The Mormons practice genealogy because their religion dictates it.

But it doesn't stop there. "There are historians—either social historians or demographers—who get involved with genealogy when they do population studies and trace migration movements. Then there are those who are involved in medical and health research—on causes of mortality and vital statistics about hereditary diseases," says Dearborn.

Computing your lineage

All these newfound genealogists have a problem: They're suffocating under reams of pulp. Once you start to trace your history, "you accumulate box after box of notes and records. You can get swamped," says Paul Andereck, editor of the *Genealogical Computing* newsletter. "Your manual filing system breaks down from sheer overload. You have the index of your records in your head, which means that when you die, no one will

Rita Parker is an active participant and analyst in the computer field who currently resides in California.

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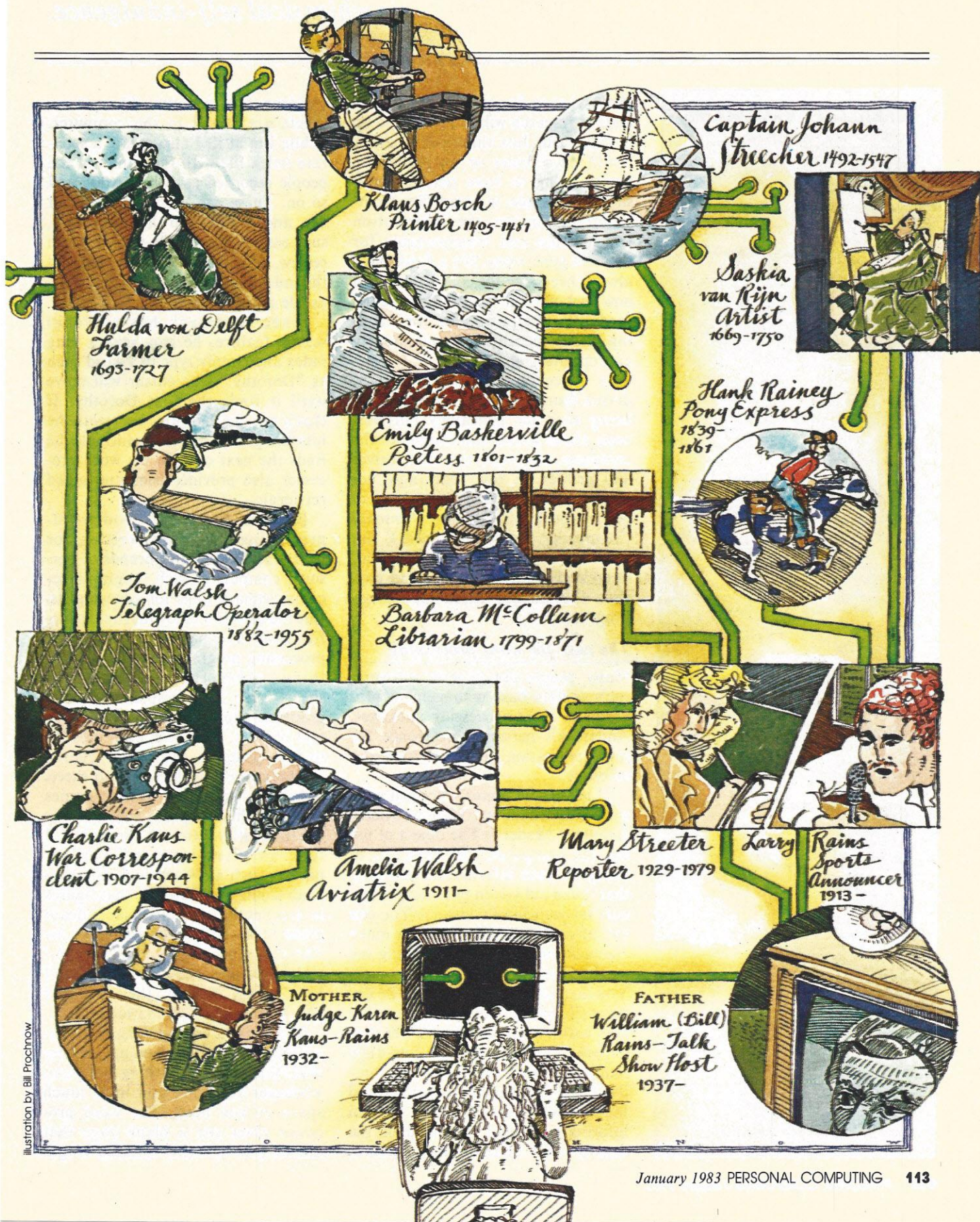


Illustration by Bill Prochnow

*Since genealogy has become
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know what to do with the records. So all that research will probably end up in the trash. Just think—if you're a Smith or a Jones or an Anderson, you're going to have tens of thousands of people in your file. Computerizing makes the information transferable and transportable for the next generation. It's a field that's always been ripe for computers. And now that personal computers are affordable, computer use for keeping these records is tremendously appropriate."

In a recent reader survey, Anderreck found that the average system being used for genealogy purposes costs about \$4100 and comprises the computer, monitor, two disk drives and printer. A few years ago, not much could be found in the way of genealogical software (see *Personal Computing*, September 1979), but there are now over 18 packages that interested family historians can buy. (See the sidebar titled Genealogy Programs.)

The case for word processing

Many people use generic software, such as data-base management programs or word-processing packages. Anderreck's personal preference for this application is word-processing software.

"I use Radio Shack's Scripsit software program on my TRS-80 Microcomputer Model I. The object of using the computer," he says, "is to dump all your information into it so that it can aid you in preparing printouts for your family history. You can call up a file and fill in data or make changes and additions by moving the cursor randomly around the screen. You then save that completed file under a file name. The system I use begins with an initial, like 'A' for Anderreck, then a four- or five-digit number for each member of the family. These files become individualized family group sheets, which contain information about the head of the family—his birth, death, spouse,

children and parents. Then these sheets are stored in the computer. While I'm at it, I also create a separate index file with the names of the people recorded as A004, A005 and so on. These are the file numbers I use, and if I call up these numbers, sure enough there's the record. I can review, add, change or print out. And the index lists the numbers that I use as file names."

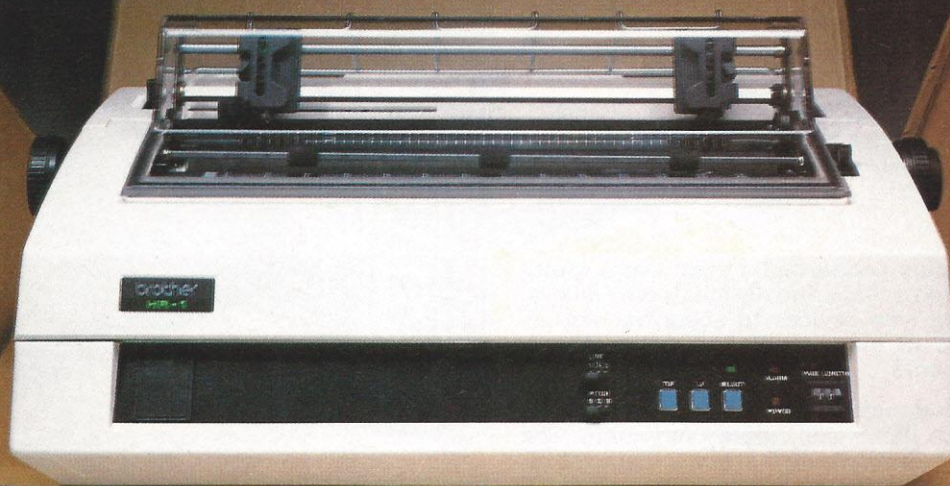
Since Anderreck has a global search feature, he can have a long index and simply type in a word such as "Dorothy." The cursor will move until it finds the first Dorothy. If that's not the Dorothy he wants, he hits the global search again until he finds the next one. So his word processor also provides computer-aided retrieval.

Because there are good word-processing programs written for nearly all models and brands of personal computers, such programs become primary tools for genealogists. But the user can enjoy multiple benefits from one package. The word-processing programs can be used for things other than family group sheets, such as correspondence, biographical sketches and recording the text of wills. Anderreck even uses his to draw pedigree, or ancestor, charts.

The usefulness doesn't stop there. "My disk operating system comes with a utility program that permits me to identify letters A through Z. I take an often-repeated word or phrase, such as Woodstock, Shenandoah County or Virginia, that figures in frequently as a birthplace, death place or marriage place. Then I assign that place to, say, the letter 'A,' which becomes a control key. When I hit Control A from then on, that phrase comes in automatically."

If you use a word processor for genealogy applications, you get another plus: You can say anything you want, whenever you want and in as much space as you need. The word processor gives you a blank page that allows you to write variable length

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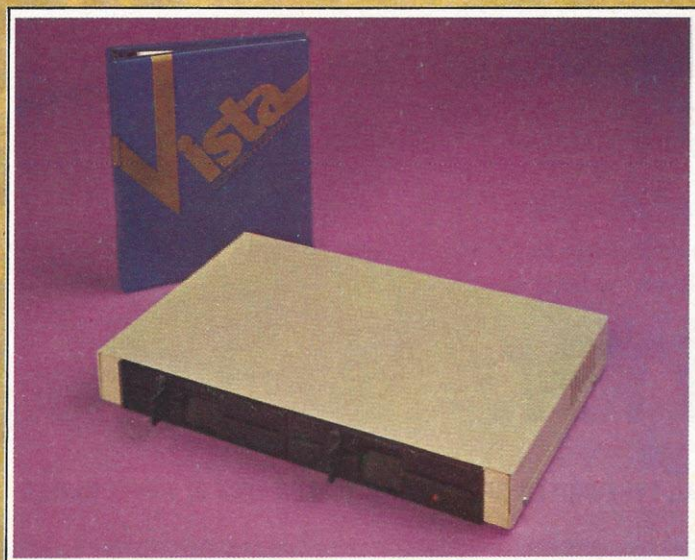
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Genealogists agree that tracing roots is an addictive hobby that yields the benefit of passing on information to future generations.

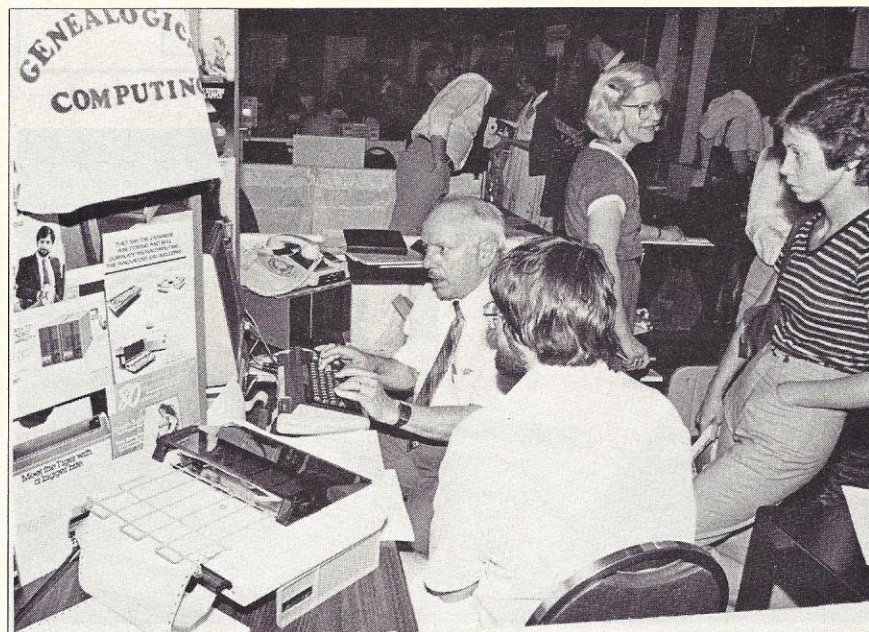
records. A genealogist can add as much information as he wants in the process of unraveling a family history. "So one record," says Andereck, "may be short and another, like the one for my brother who had four wives, can be long."

The data-base approach

The flexibility, some genealogists argue, that word processing gives the historian is a tradeoff for the inability to compute with word-processing software. "The machine can't call up the name of a person and automatically link that person's file to the father's and other records. Only special data-base management programs can actually chase up and down your family tree, picking out and printing anything you want," Andereck adds.

Some genealogists successfully use data-base management software to maintain their records. Others think the specific genealogy programs are ineffective in handling this data. An advantage of general data-base management software is that it allows you to create your own files. To do genealogical studies, you could, in effect, decide what parameters you want to set down, such as place of birth, date of birth, place of marriage and so forth, and then fill in whatever information you want. But the dBase II system by Ashton-Tate in Los Angeles, Calif., for example, costs around \$700. So unless you have use for the system's general business functions, it could be too expensive for the do-it-yourself genealogist.

On the other hand, specific genealogy software packages, which range in price from about \$20 to \$500 (see the sidebar), come with fields, or parameters, already set up, so that the user inputs information according to a preselected format. These programs are also limited to a certain number of characters per file. As such, you can only include information to the point of the program's memory capacity. And if, for exam-



Paul Andereck, publisher and founder of the *Genealogical Computing* newsletter, demonstrates to some of his staff and visitors how personal computing aids in the search for a family-tree. He is using one of the available genealogy programs.

ple, you want to include narrative statements, such as a note that your great-grandfather was killed by a horse or that he was buried in a particular cemetery, you'll usually find that the program does not have enough memory to allow the statement. It is Andereck's feeling that most data-base management genealogy programs available today have too little memory to handle the voluminous data a genealogist ordinarily keeps.

One way around this problem is to break up a file, effectively using the data-base management program twice. For example, the genealogist can keep marriage and children in one file and vital records, like birth and death, in another. "You would use a common reference point in both files. You'd have to print out both files, then, to get a record on a person, but that's because of the limitation built into the data-base management program. I've heard that dBase II has fantastic flexibility and that its size isn't as limited as other data-base managers are. I'd call programs that

have flexibility and large information capacity 'industrial-strength' data-base management programs, and they're well suited to the genealogist," Andereck says.

If you're interested in using one of the 18 genealogy-specific programs available, you must determine whether or not the program will suit your individual method of record keeping. An amateur historian might, for example, like to record occupations and religious denominations, but available software may not allow him to do so. Or he may want to record the day, month and year of events, since he has already accumulated information that way, but the software may require that he enter year, month and day. There will always be some variation, though, between the records people start to keep in their manual filing systems and what they have to do when they use a specific genealogy program.

Getting started

Everyone has a natural curiosity about his heredity. "Exactly what's

photo by James R. Schlosser

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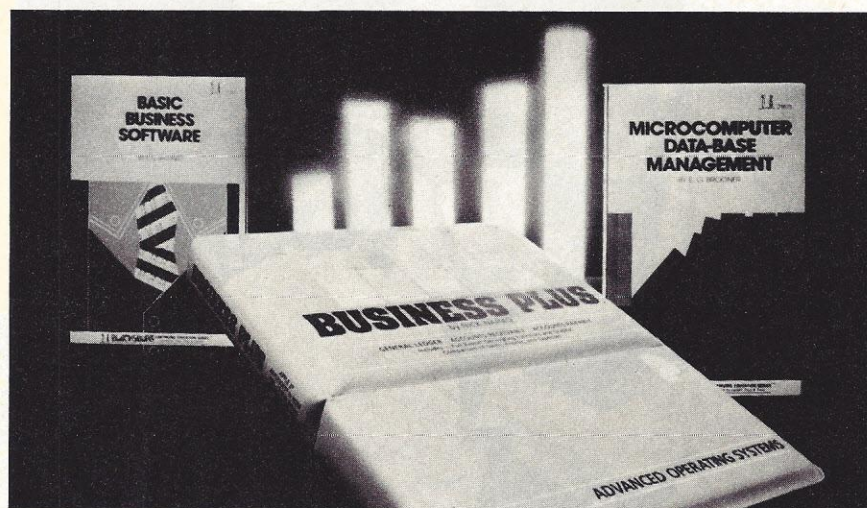
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lurking in my genes?" the potential genealogist may ask. Since genealogy has become such a national pastime, no one need worry that getting involved with his family history is whimsical self-indulgence. As Andereck says, now that computers are affordable and easy to use, anyone can use a computer for ancestor tracing.

Where to start? Most genealogists suggest that the seeker begin by talking to the older or more knowledgeable members of his family. Ask questions. Poke around in family attics. Look for old pictures, copies of marriage certificates, naturalization papers, military discharge papers, newspaper clips of weddings and obituaries. A family Bible may also help. The new researcher can also visit his family cemetery, which often holds a lot of new information on old tombstones.

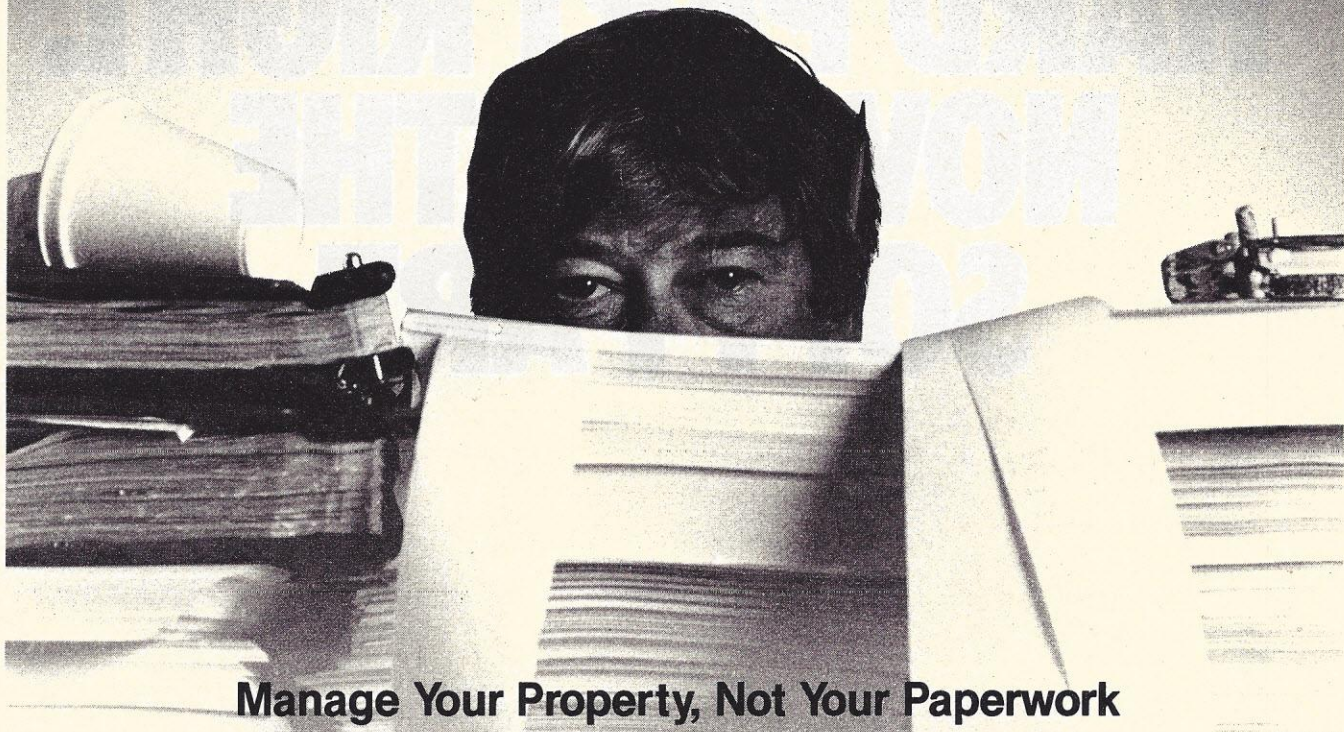
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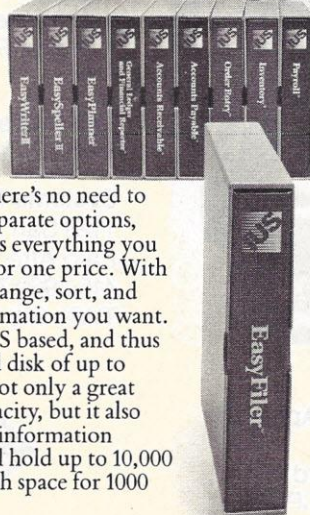
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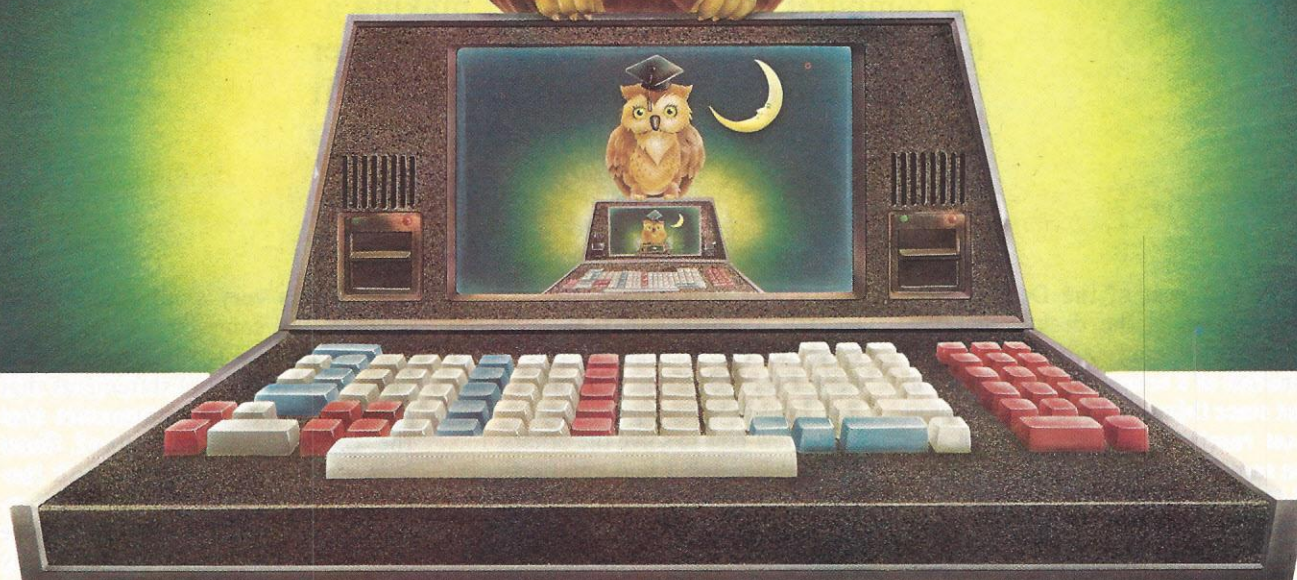
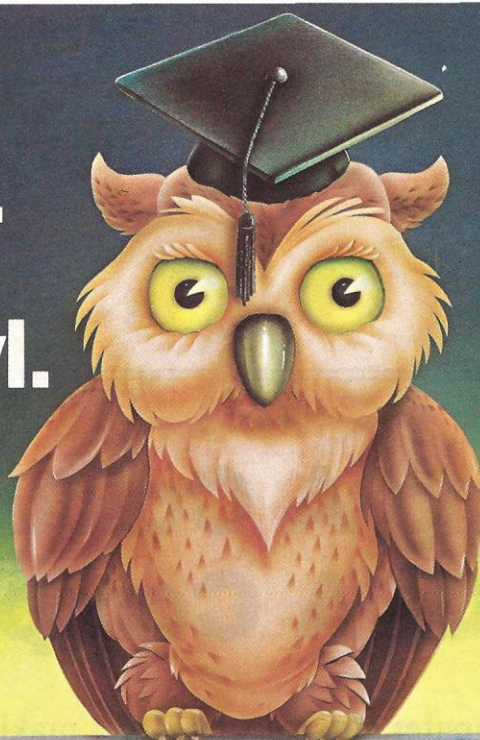
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Making A Calculator Out Of A Computer

A computer can calculate. But making a four-function calculator out of a computer isn't as simple as it seems at first blush. It turned out to mean writing a minicomputer

by Leon Starr

The last part of the Desk Master program is the desk calculator. That seems easy, since the major function of a computer is calculation. But since things in life are never, or at least rarely, what they seem, it was the same with the calculator function of Desk Master.

The first problem stems only indirectly from the calculator function itself. This function of Desk Master would take a lot of space in memory because of its dimension, and Desk Master itself is pretty big. I had to assume that the user would have a 48k computer, a fairly common size. I realized that the calculator program would have to be a subprogram, because the whole thing couldn't fit into main memory with the rest of Desk Master.

Fortunately, personal-computer DOSs aren't too tough to use. I knew I could get from one program to another by simply telling the computer, in the program itself, that I wanted it to load and run another program from the disk. Then the only problem was the requirement that the proper disk should be in the drive. But I al-

ready had that solved, because I'd written a routine that checked the drive for the presence of the proper disk. I felt good that I found a problem I could solve right away.

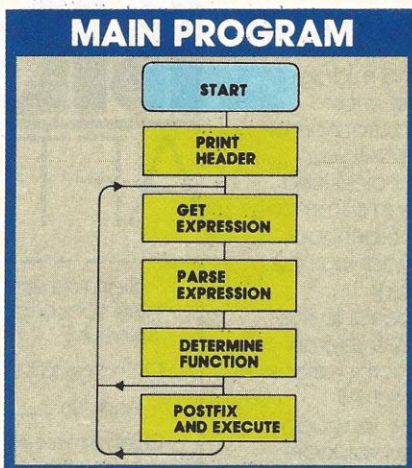
I knew how to solve the others, too, but not because I had any particular genius. Rather, I had taken some courses in compiler theory at the University of California at Santa Cruz, and I realized that the problem fac-

ing me was very similar to that of developing a compiler.

A compiler is really a program. It acts as a translator of statements that the user makes into statements that the computer can understand. Since it is a translator, it works with languages: human-comprehensible languages and machine-comprehensible languages. The people who originally developed compilers talk in terms similar to those used by grammarians. Parsing, syntax, grammar and so forth are common terms around the laboratories where compilers are developed. When I use them here, it's because they work.

The problem I faced was the need to have the computer understand simple algebraic expressions and evaluate them. BASIC can do that, of course. You simply type PRINT 2*2 into BASIC with no preceding line number and the computer evaluates the expression and returns the value 4. If I thought I could just use BASIC, my problem would have been a trivial one.

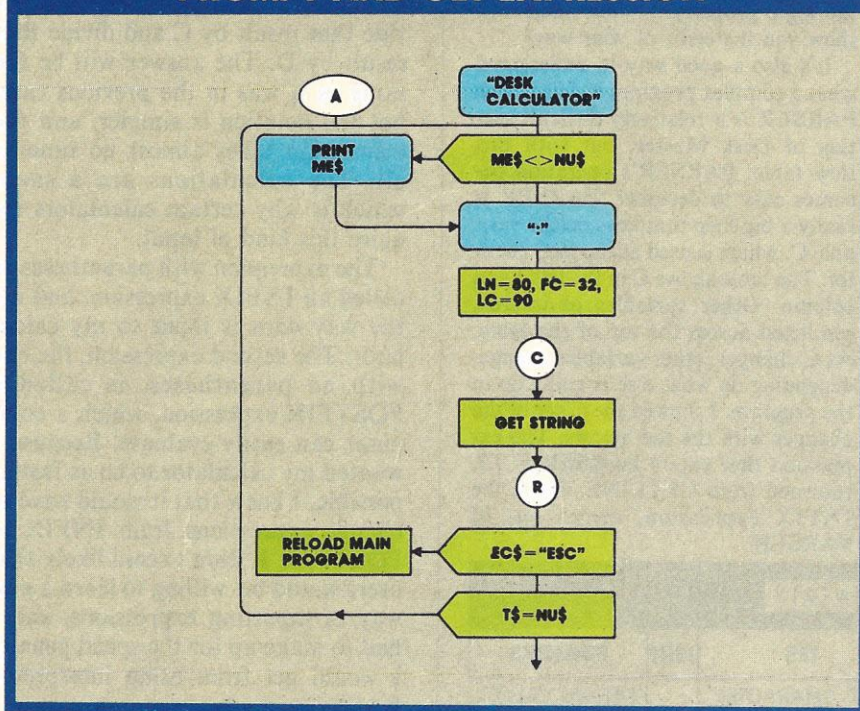
I called some of the computer makers to ask them about the assembly-language calls I'd need to access the BASIC interpreter from inside a program. I didn't just want to use BASIC directly, because that



The main part of the calculator subprogram has five major sub-sections. The last, POSTFIX AND EXECUTE, is actually a subroutine that's called from more than one place in the program. It is the routine where the most action takes place.

Leon Starr is a principal of Educomp, a firm that trains people in the use of computers.

PROMPT AND GET EXPRESSION



PROMPT AND GET EXPRESSION uses **GETLINE** to garner the user's expression.

would mean getting out of Desk Master so BASIC could be accessed in immediate mode—which would be a hassle for the user. The computer makers couldn't understand why I didn't want to use BASIC directly, and in hindsight, I understand what they meant. But I was back to square one, and since I didn't know a lot about any of the popular microprocessors' **ASSEMBLY** routines, I was stuck with writing a compiler in BASIC to get the job done.

Compilers can be written in any language. Many compilers today are written in C, a language that was developed at Bell Telephone Laboratories. Programmers like C because it is a structured language—one that is easy to write in a logical manner. Pascal has similar easy-to-structure features. BASIC doesn't. The virtue of BASIC is that it's easy to learn. The flip side is that it's hard to get BASIC to do a lot of things that other

languages can do nicely. Then, too, most compilers are themselves compiled after they are developed, so they are fast in execution. My compiler had to be able to operate on interpreted BASIC, which meant I had to expect that it would be slow. These are just some of the reasons why compilers usually aren't written in BASIC, although since I did it, I know it can be done.

Begin at the beginning

I've mentioned in previous articles that many computer programs want the user to input expressions in a form that's easy for the computer, but not necessarily easy for the user. That's true of other devices, too, such as a calculator that uses reverse polish notation.

One way of writing an algebraic expression uses parentheses, which people are used to. An example follows.

$$(A*B)/(C*D).$$

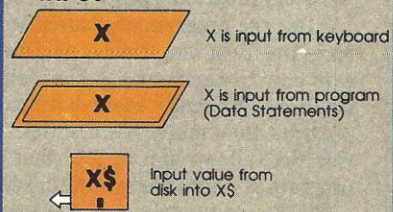
This means multiply A times B to get a result, which you can call E. Multiply C times D to get a result, and call it F. Then divide E by F, and output the answer. A lot of translation is required to get to the answer.

It's easier for the computer to get the expression without parentheses, like this:

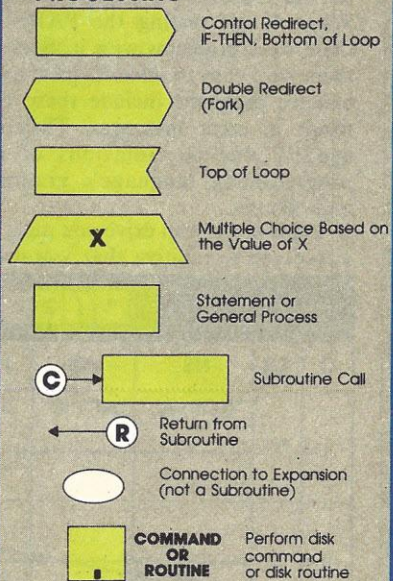
$$AB*C D.$$

FLOW CHART SYMBOLS

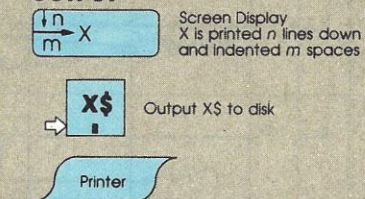
INPUT



PROCESSING



OUTPUT



"I realized the calculator program would have to be a subprogram."

STEPPING THROUGH THE PROGRAM

There comes a time in the life of every program when it won't work.

After the programmer stares at his program for a long time and fiddles with one statement or another with no result, he frequently uses what I call a program flow table. It's a simple device that allows him to see what the program is really doing with his data.

The flow table I've reproduced here for the PARSER is a good example. When I was testing the PARSER, there were problems with it. Some of them were easy to solve. Typical easy-to-solve problems include those that result in error messages. They are usually due to violations of the programming language's grammar and syntax.

Logic errors can drive you nuts, because you're positive that you coded

the logic properly. A flow table can show you the error of your ways.

It's also a good way to understand what a complex program is doing. The PARSER is a relatively difficult section of Desk Master, but with this flow table, PARSER's operation becomes easy to decipher. PARSER is really a big loop that keys on the variable C, which is used as the loop counter. The table shows C in the left-hand column. Other variables of interest are listed across the top of the table. As C changes, other variables change, depending on what else is going on in the program. I showed the order of the changes with the red arrows. The expression that enters PARSER is T\$, returned from GETLINE. I\$(1), the INFIX expression, comes out of PARSER.

T\$ = " (2 + 4) * 6 " PARSER							
C	C\$	N\$	IN\$	I	TP\$	IS(I)	REMARKS
1	"("	"NOT VAL"	"NOT ID"	0	"BAD CHARACTER"		DEFAULT VALUES
2	"2"	"VAL"		1	"OPERATOR"	"("	1ST PASS THROUGH LOOP
3	"+"	"NOT VAL"		2	"NUMERIC"	"2"	IN\$ BECOMES "VAL" TO SKIP LOOP IF NUMBER HAS > 1 DIGIT
4	"4"	"VAL"		3	"OPERATOR"	"+"	ONLY 1 DIGIT IN\$ BECOMES "NOT VAL"
5	")"	"NOT VAL"		4	"NUMERIC"	"4"	
6	"*"			5	"OPERATOR")"	
7	"7"	"VAL"		6	"NUMERIC"	"*"	
				7	"NUMERIC"	"7"	

I\$ = (2 + 4) * 6

If the computer does things in the order that it reads them, it will take A and then B, multiply them, then divide that result by C and divide that result by D. The answer will be the same as it was in the previous case, but the notation is simpler, and the translation takes almost no time at all. The calculations are a snap, which is why certain calculators require this kind of input.

The expression with parentheses is called an INFIX expression, and it's the way data is input to my calculator. The second expression, the one with no parentheses, is called a POSTFIX expression, which a computer can easily evaluate. Because I wanted my calculator to be as fast as possible, I knew that it would have to change expressions from INFIX to POSTFIX. It didn't seem likely that users would be willing to learn a new way of inputting expressions, and I had to make up for the speed penalty I would get from using interpreted BASIC as my language.

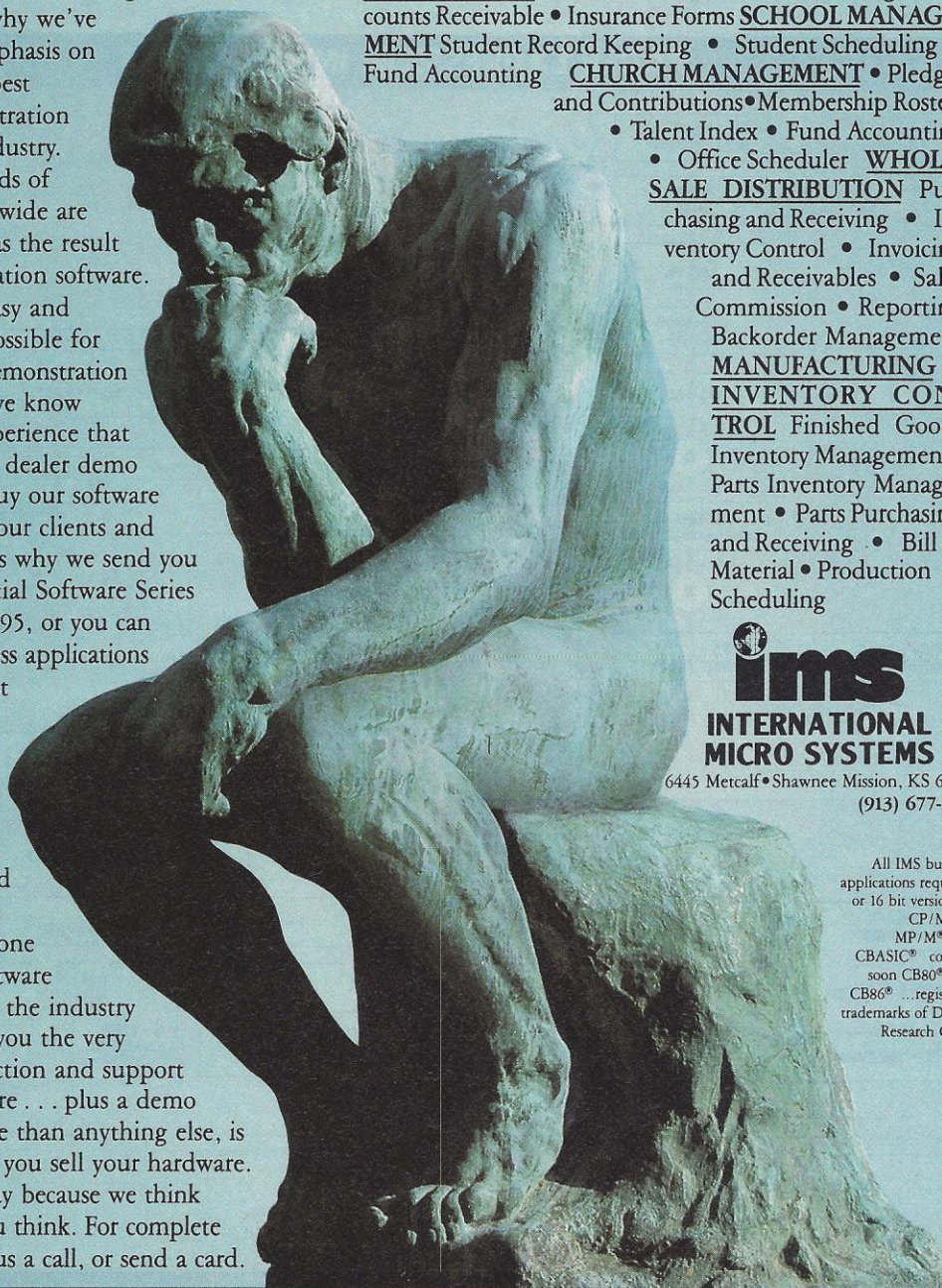
Before I could even begin the translation from INFIX to POSTFIX, though, I had to know what I was working with. That meant I had to get the string that represented the expression the user wanted to evaluate and decide, somehow, what the parts of that expression were. I had to parse the expression into smaller, indivisible parts, called tokens.

Tokens are sometimes single characters, but not always. All of the following symbols (separated by commas) are examples of tokens: A, AB, 5, 500.29, (,), *.

As I played around with the notion of a PARSER, I realized that other things could creep in as well—things like extra blanks and bad characters that couldn't be understood by the PARSER I would write. I knew I'd have to do something else, too. I'd have to analyze the syntax of the user's expression to make sure it was correct. If it wasn't, I'd have to have the program deliver an error message. Analyzing the syntax should go

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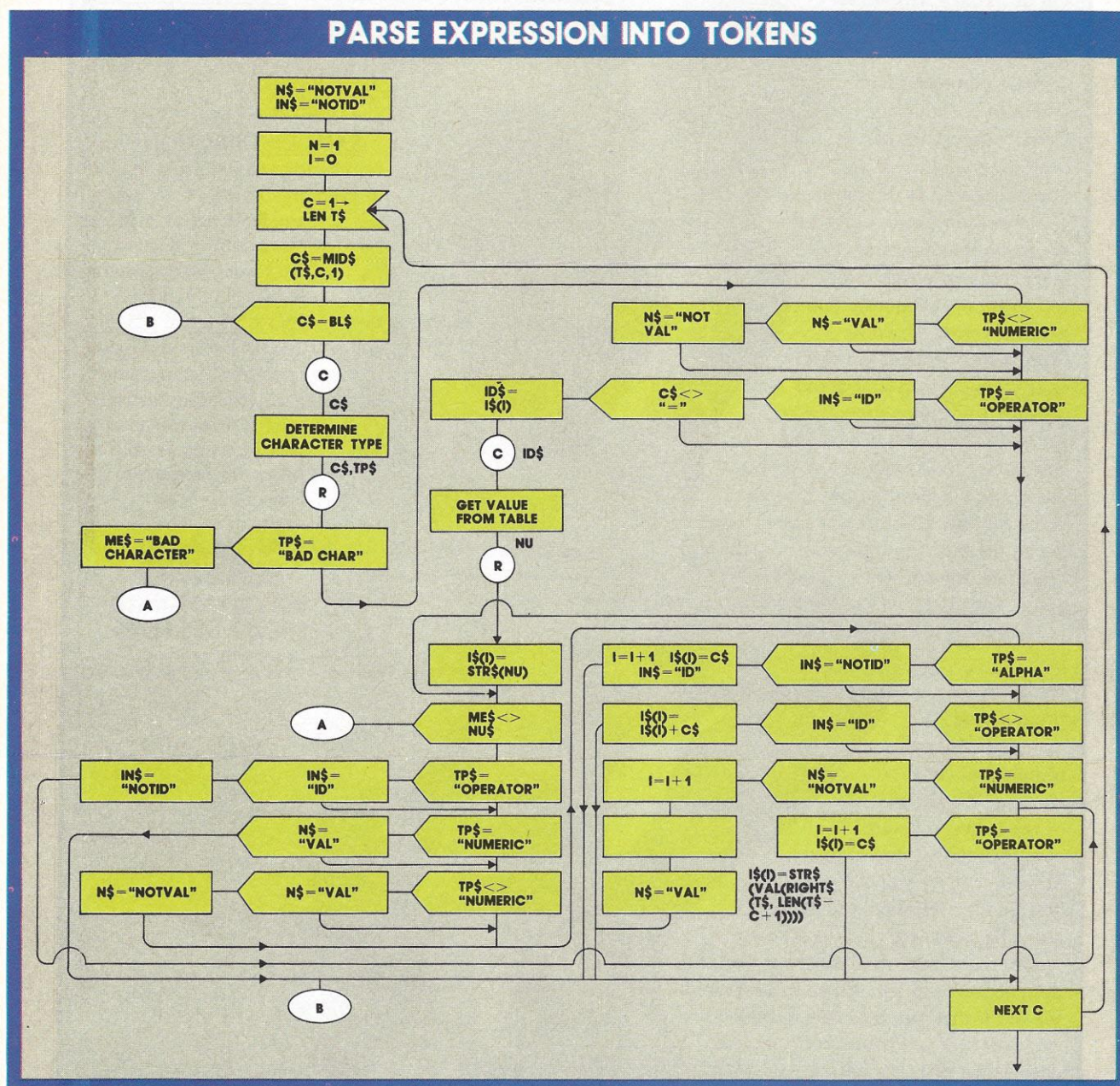
"If there's only one token, I know it's a command."

on as the expression is being parsed. That makes sense because it's the parsing that determines what the tokens are. If the PARSE comes up with a token it can't understand, it shouldn't pass that misunderstood token to the later stages of the pro-

gram. It should stop right there and wait for something it can understand.

The PARSE has to have an expression to work with. I was fortunate in that I had a routine that would provide the expression that I'd already written for Desk Master—

GETLINE. I had to write it again, because this was going to be a separate program due to the memory limitations. But since the skull work was already behind me, I didn't mind. I decided I'd use GETLINE to get the
(continued on page 130)



PARSER figures out what the tokens of the input expression are. It has a multitude of IF/THEN expressions that act as filters, diverting different classes of tokens into their appointed storage locations in the INFIX array, which is I\$(I).

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	12.5	—	—	150	150
	13.3	200	200	—	—
	15	—	—	180	180
	16.4	—	—	200	164
	10	—	—	—	100
Enhanced Expanded Print (Double Width)	Yes	Yes	Yes	Yes	Yes
Dot Addressable Graphics (Dot/In., H/V)	60/72	60/72	75/72	75/72	72/72
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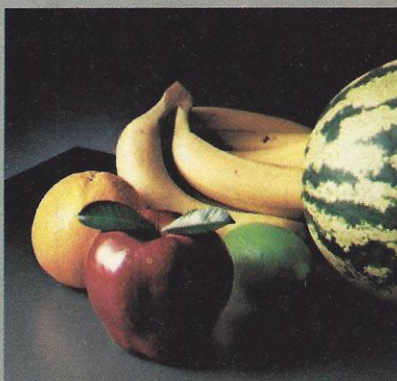
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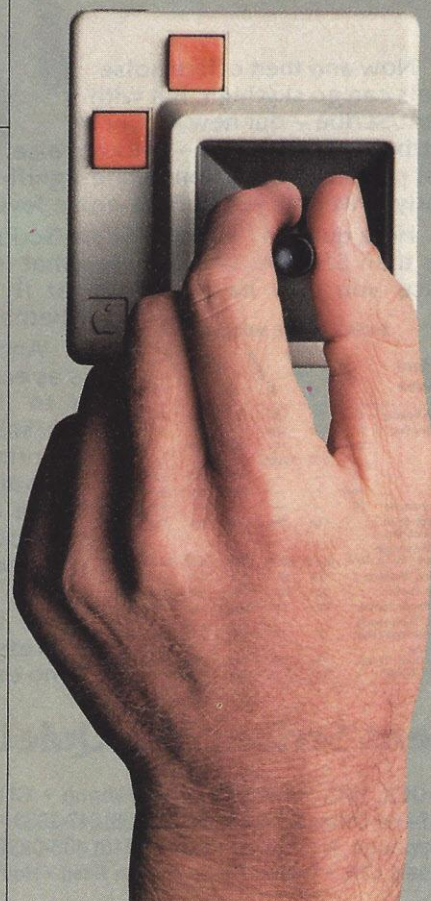
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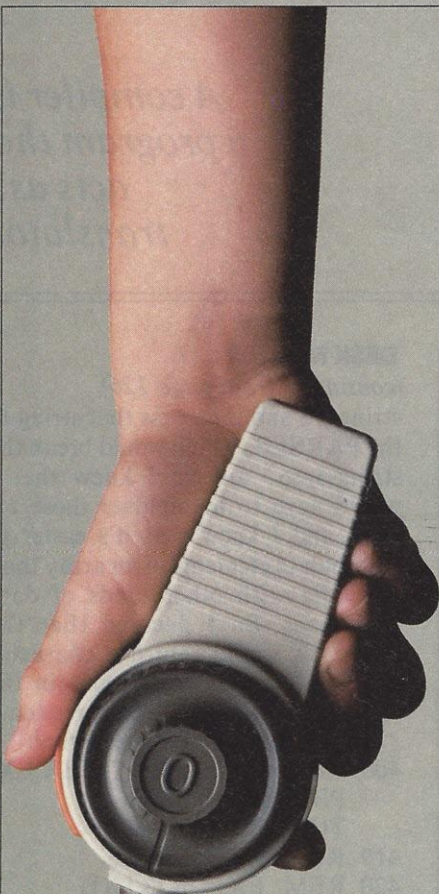
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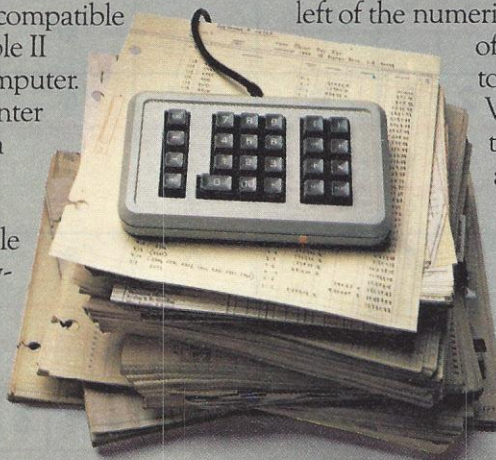
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*A compiler is
a program that
acts as a
translator.*

<div> <div>I\$ = (2 + 4) * 6</div> <div>POSTFIX</div> </div>										
C	TP	P	PC	PS	I\$(C)	P\$(P)	S\$(TP)	IB	C\$	N
1	0	0			"("			1	"("	0
	1			1					"("	
1	1	0	1	1	"2"		"("	1	"2"	0
2				1					"2"	
2	1	1	1	1	"2"	" "	"("	1	"2"	0
3				1	"+"				"+"	
3	2			0					"+"	
3	2	1	1	1	"+"	"2"	"+"	1	"+"	0
4				1	"4"				"4"	
4	2			1					"4"	
4	2	2	1	1	"4"	"4"	"+"	1	"4"	2
5				1))	
5	0	3	1	1)	"+"	"+"	1)	1
6				1	"*"				"*"	
6	1	3	2	0	"*"	"+"	"*"	1	"*"	1
7				1	"6"				"6"	
7	1	4	1	1	"6"	"6"	"*"	1	"6"	1
	0			5					"*"	
	0								"*"	0
<div> <div>AFTER POSTFIX, P\$ = 2 4 + 6 *</div> </div>										

DESK MASTER

(continued from page 126)

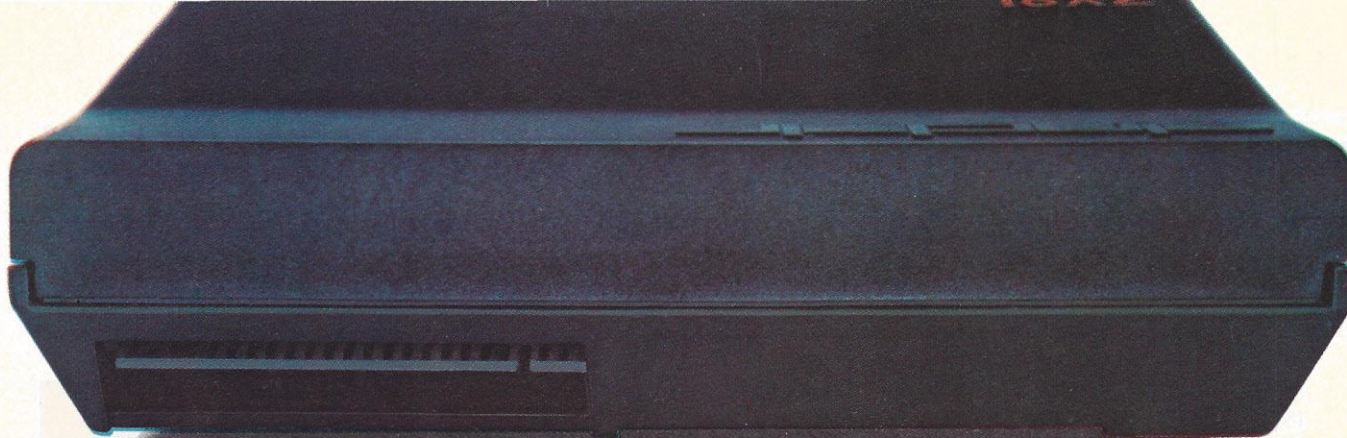
string T\$ and then pass that string to the PARSER, which would break the string into tokens. I knew that I would have to manipulate those tokens, and I knew that it's easier to manipulate elements of an array than to fiddle with other kinds of data structures. So I decided that the PARSER would return a character array I\$(I), that would contain the tokens from the INFIX expression.

Here's the code for the parser:

```

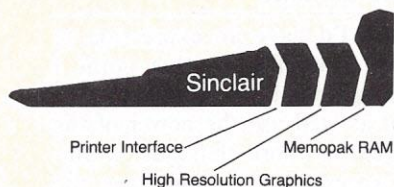
400 REM *** PARSE INFIX EXPRESSION INTO
    TOKENS ***
410 REM IMPORT: T$
420 REM EXPORT: I$(I)
430 REM
450 N$ = "NOTVAL":IN$ = "NOTID":N = 1:I = 0
460 FOR C = 1 TO LEN (T$)
470 C$ = MID$(T$,C,1)
475 IF C$ = BL$ THEN GOTO 570
480 GOSUB 5000: REM GET CHAR TYPE TP$
485 IF (TP$ = "BAD CHAR") THEN ME$ = "BAD CHARACTER": GOTO 300
486 IF (TP$ "NUMERIC") AND (N$ = "VAL") THEN N$ = "NOTVAL"
490 IF (TP$ = "OPERATOR") AND (IN$ = "ID") AND (C$ <> "=") THEN ID$ = I$(I): GOSUB 1400: I$(I) = STR$(NU): IF ME$ <> NU$ THEN GOTO 300
491 IF (TP$ = "OPERATOR") AND (IN$ = "ID") THEN IN$ = "NOTID": GOTO 508
493 IF (TP$ = "NUMERIC") AND N$ = "VAL") THEN GOTO 570
496 IF (TP$ <> "NUMERIC") AND (N$ = "VAL") THEN N$ = "NOTVAL"
499 IF (TP$ = "ALPHA") AND (IN$ = "NOTID") THEN I = I + 1:I$(I) = C$:IN$ = "ID": GOTO 570
502 IF (TP$ <> "OPERATOR")

```



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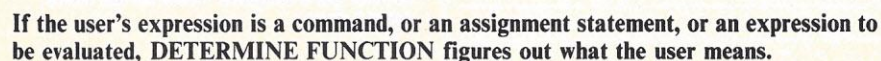
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Account No.			Exp.
Name			
Address			
City		State	Zip

```

GOTO 570
570 NEXT
580 IF (IN$ = "ID") AND (I > 1)
    THEN ID$ = I$(I): GOSUB
    1400:I$(I) = STR$(NU) : IF
    ME$ <> NU$ THEN GOTO
    300

```

It's probably difficult to decide what the parser is really doing. I know it works, because after I wrote



P\$ =		2	4	+	6	*	EVALUATE
C	P	P\$(C)	TP	S(TP)	S(TP-1)		
	J		0		—		
1	5	"2"	1	2	—		
1	5	"2"	1	2	—		
2	5	"4"	2	4	2		
3	5	"4"	2	4	2		
		"+"	1	6	—		
3	5	"+"	1	6	—		
4	5	"6"	2	6	6		
4	5	"6"	2	6	6		
5	5	"6"	2	6	6		
		"*"	1	36	36		
			1	36	—		

it, I spent a lot of time testing it on all kinds of expressions. See the sidebar titled **Stepping Through The Program** for an easy way to figure out what the code does.

What to do now?

I figured I'd have an expression to evaluate now. But at this point I stopped again to think. I realized that I might as well use the power of the computer for more than just evaluating expressions. I could have the machine teach the user how to use the calculator by listing some example entries. I could make the computer print the work to a printer. I could assign values to literal expressions and then use those literal expressions in place of the numbers they represented. So I needed a part of the program that would decide what the user wanted to do. I needed to determine the function that was required of my calculator.

I set it up so all the functions other than calculating an expression would be accessed by one-word commands. That makes determining the function easy. GETLINE gets the string that is the one-word command, or the expression to evaluate. The PARSER decides what the tokens are in the expression. If there's only one token, then I know I've got one of my one-word commands, and I go through

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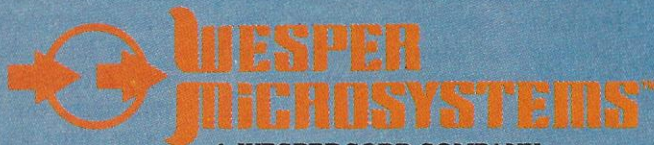
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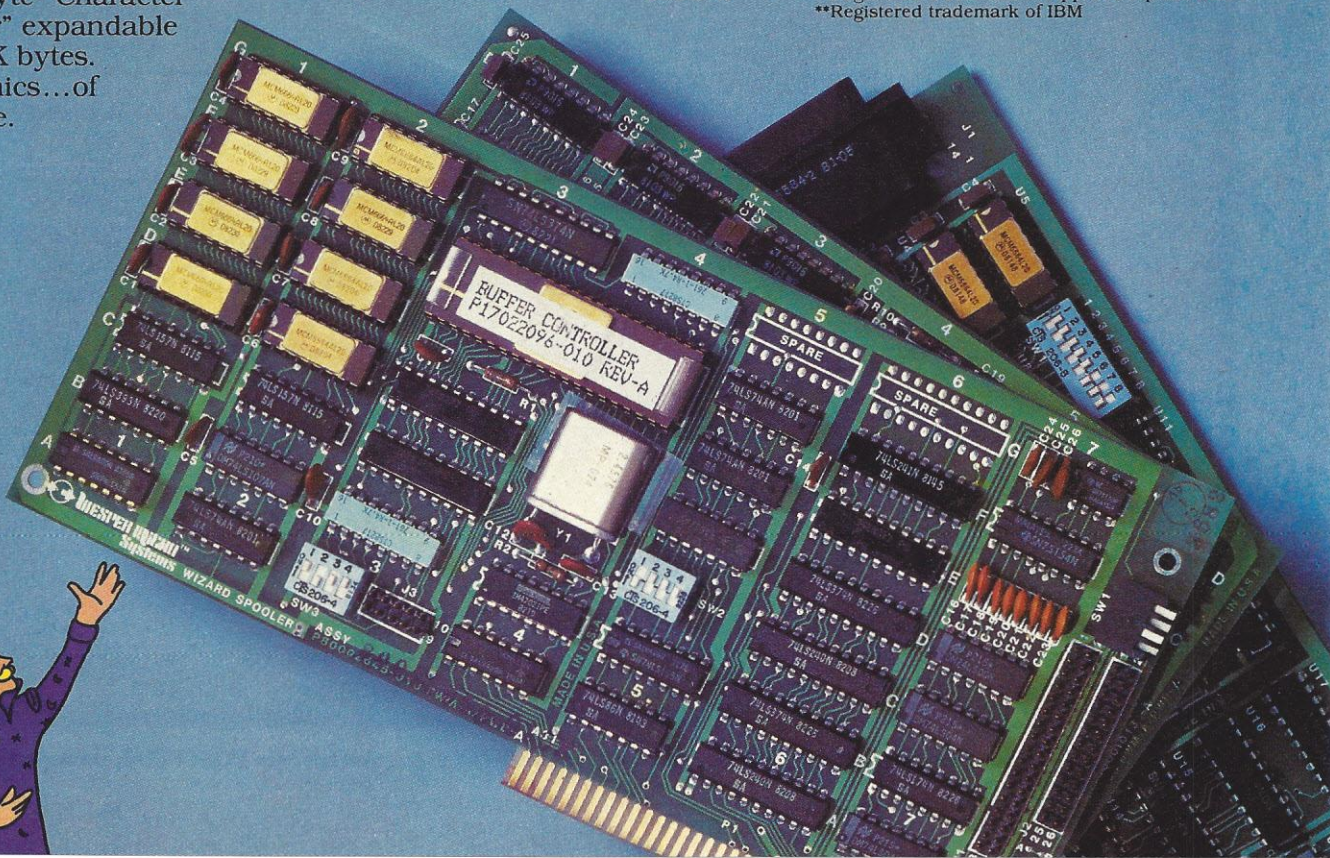
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"I wanted my calculator to be as fast as possible."

the list of possible commands to determine which one I've got. Otherwise I have an expression to evaluate—almost.

The only other fly in the ointment is the possibility of an assignment statement. Suppose the user wanted to assign $A = 3.5$. The **PARSER** would return three tokens— A , $=$, and 3.5 . (I knew at the start that I would make the **PARSER** ignore blanks. They are helpful for human comprehension, but only take up space in a computer's memory.) The second token is an equals sign. It will always be an equals sign if I want to assign a variable name. I could check for that, and if the second token, $IS(2)$, isn't an equals sign, then I really have an expression to evaluate.

Finally, evaluation

I knew there are only two ways that

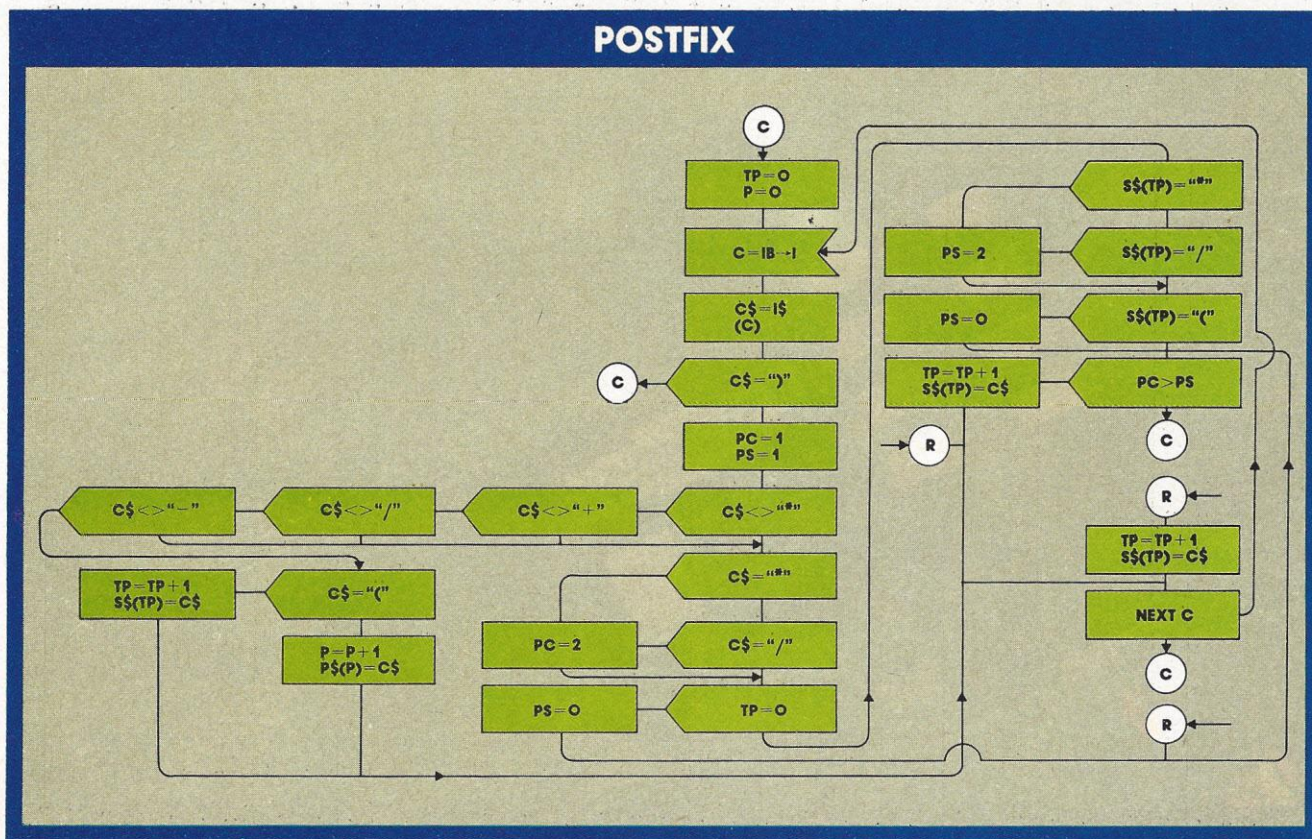
the program could get to evaluation. The first is that the **INFIX** expression is an algebraic expression that needs to be evaluated, which is straightforward. The second is the assignment of the result of some expression to a variable name. In either case, the **INFIX** expression, either the whole expression or the right half of some equation, has to be **POSTFIXed** and then evaluated. I used a parameter, **IB**, to tell the **POSTFIX** routine which case to deal with. After **POSTFIX** did its postfixing, then it could evaluate the expression and return the answer. The actual evaluation was a snap after the postfixing was accomplished.

The basic idea behind **POSTFIX** is very difficult to explain. I wrote the procedure the way I did because I knew from the courses I had taken that this was the way it had to be

written. Now, after the fact, when the code is all down on paper, I have to go back and step through the code again to understand how the whole thing works. What follows is the **Desk Master** code that does the **POSTFIX**.

```

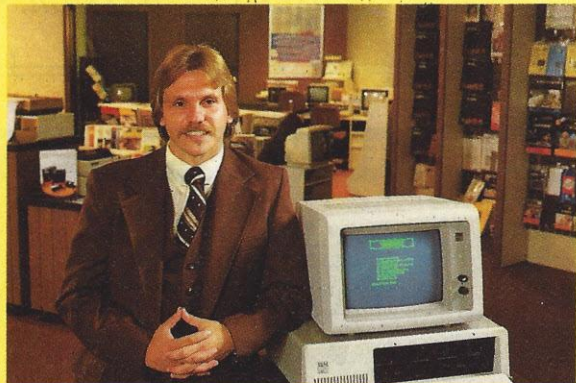
1000 REM *** POSTFIX AND
      EXECUTE ***
1010 REM *** REM INFIX TO
      POSTFIX
1020 REM *****
1030 REM IMPORT: IS(I)
      EXPORT: PS(P)
1040 REM
1050 REM POSTFIX FROM IS
      TO PS
1060 TP=0:P=0
1062 FOR C=IB TO I
1064 C$=IS(C)
1066 IF (C$="") THEN GOSUB
      2000: GOTO 1090: REM
      EMPTY OPSTACK
1068 PC=1:PS=1
  
```



POSTFIX is the routine where most of the action takes place. After the **INFIX** expression has been **POSTFIXed**, evaluation is a snap.

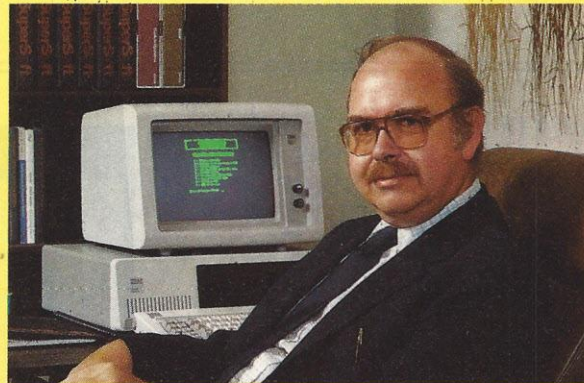
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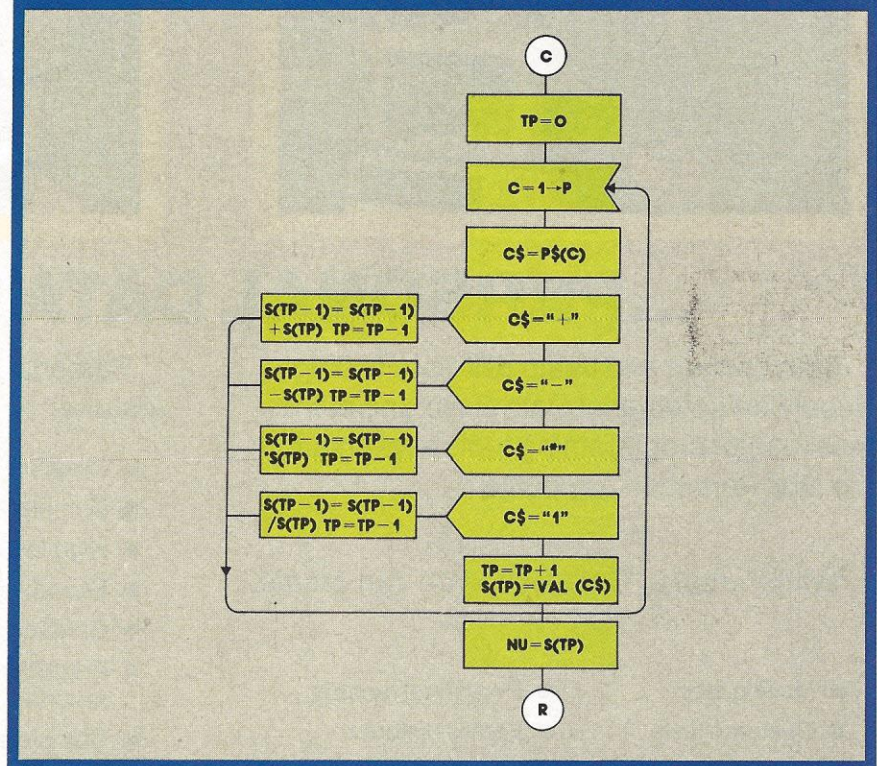
"I realized I'd have to analyze the syntax of the user's expression."

```

1070 IF (C$(<>) "*" ) AND
      (C$(<>) "+" ) AND (C$
      (<>) "/" ) AND (C$ (<>)
      "-" ) THEN GOTO 1084
1072 IF (C$="*" ) OR (C$="/" )
      THEN PC=2
1074 IF TP=0 THEN PS = 0:
      GOTO 1080
1076 IF (S$(TP)="*" ) OR
      (S$(TP)="/" ) THEN PS=2
1078 IF S$(TP)="/" THEN PS=0
1080 IF PC > PS THEN TP=TP
      + 1:S$(TP)=C$: GOTO 1090
1082 IF PC <= PS THEN
      GOSUB 2000: TP=TP +
      1:S$(TP)=C$: GOTO 1090
1084 IF (C$ "(" ) THEN TP=TP
      + 1:S$(TP)=C$: GOTO 1090
1086 REM IDENTIFIER
1088 P=P+1:P$(P)=C$
1090 NEXT
1092 GOSUB 2000: REM EMPTY
      STACK
1140 REM *** EVALUATE
      POSTFIX***
1150 TP=0
1160 FOR C = 1 TO P
1170 C$=P$(C)
1180 IF C$="+" THEN S(TP-1)
      = S(TP-1) +S(TP):
      TP=TP-1: GOTO 1230
1190 IF C$="-" THEN S(TP-1)
      = S(TP-1)-S(TP): TP=TP-1:
      GOTO 1230
1200 IF C$="*" THEN S(TP-1)
      =S(TP-1)* S(TP):TP
      =TP-1: GOTO 1230
1210 IF C$="/" THEN S(TP-1)
      = S(TP-1) / S(TP):
      TP =TP-1: GOTO 1230
1220 TP=TP+1:S(TP)=
      VAL (C$)
1230 NEXT
1250 NU=S(TP)
1260 RETURN
1299 REM *****
-----
2000 REM *** EMPTY
      OPERATOR STACK***
2010 REM
2020 IF TP = 0 THEN GOTO 2080
2030 FOR N=TP TO 1 STEP-1
2050 IF S$(TP) (<>) "(" THEN
      P = P + 1:P$(P) = S$(TP)

```

EVALUATE POSTFIXED EXPRESSION



EVALUATE merely collapses a shuffle stack in upon itself. The one value that remains is the answer the user really wanted in the first place.

```

2060 TP = TP - 1
2070 NEXT
2080 RETURN

```

POSTFIX uses a data structure called a stack. A stack is nothing more than an array that is accessed in a certain way. The term originates from a data structure that had items added to the top of the structure only. If that method of adding data is followed, then the previous entries in the structure are pushed down into the stack in much the same manner that plates in a plate-dispensing appliance in a cafeteria are pushed down when more plates are added to the top of the stack. The stacks I'm using here aren't push-down stacks like the one I just described, but you can think of them as stacks of data anyway. I used parameters to access the data in the stacks, and these parameters, TP, P

and C, are called stack pointers. They point to the location where I will add or remove data.

There are three stacks used in POSTFIX. First is IS(C), which contains the INFIX expression. Then there's S\$(TP), which I call a shuffle stack. That's a temporary holding place for tokens, and they will stay in S\$ until I figure out what to do with them. PC and PS are priority designators. PC is the priority of C\$, which is the variable I throw the tokens into for quick reference before moving them on. PS is the priority of whatever is in the shuffle stack. I can compare the two priorities to determine if a token is a high-priority operator, like "*" or "/", or a low-priority operator, like "+" or "-". (There are three priorities in this scheme—0, 1 and 2. If this calculator



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The shuffle stack is a temporary holding place for tokens.

included exponentiation, then I'd have to add another priority, 3, to take care of that operation.) Depending on the priority, the operator and other parameters, tokens are put into either the shuffle stack, S\$(TP), or the postfix stack, P\$(P), to be worked on later. I dimensioned P\$, S\$ and S, by the way, at 80. I thought 80 tokens was a heavy-duty equation for someone to try to figure out.

If you look at the flow chart entitled POSTFIX, you can get an idea of the logic required for this operation. It's rather difficult, though, to see what's really happening to the variables as they are shuffled from one stack to the other just by using the flow chart. It's easier to study the POSTFIX flow table, which steps the program through the operation of the POSTFIX subroutine. But before you go to the POSTFIX flow table, read the sidebar.

After I wrote the POSTFIX subroutine, I knew it would be easy to complete the guts of the calculator subprogram. All that remained was to evaluate the POSTFIXed expression. That chore really came down to examining the contents of P\$(P). If the token in a particular slot in the array is a value, then I simply put it into another shuffle stack. When I ran into an operator—there can now only be four operators since I got rid of all the parentheses in POSTFIX—I had the program perform the indicated operation and stuff the result into the preceding slot in S(TP).

Notice that I used numerical values that were used for examples in the POSTFIX and all flow tables. What happens if the user decides to enter an expression of the form TOTAL=A+B+C? In that case the PARSE encounters the set of literal values first. It stuffs whole identifiers, like TOTAL, A, B and C, into single slots in the INFIX array, I\$(I). It then calls GET VALUE FROM TABLE, another subroutine, which substitutes the value of the literal token into the INFIX array.

If there has been no value assigned to A, say, then PARSE sets ME\$ to UNDEFINED VARIABLE and returns to the prompt at the top of the program, where it prints ME\$ and waits patiently for another entry.

That's fine in theory, but...

It's tough to explain how I happened upon the particular set of instructions that would make this whole thing work. I just knew from my past work, the classes that I'd taken and some books I got at the university bookstore that this was the way to get the job done.

The PARSE, POSTFIX and EVALUATE functions are the guts of this subprogram of Desk Master. I haven't discussed other routines in much detail because they're not too difficult to envision, and they didn't take too much programming expertise to put together. Two that exist in the calculator subprogram are GET VALUE FROM TABLE and PUT VALUE IN TABLE, which take a literal expression, like A, and then check the table of assigned values for a match. If there is a match, then GET VALUE returns the value sought, or PUT VALUE writes the value in. If there's no match, then GET VALUE returns an error message, and PUT VALUE creates a new value in the table.

This raises the problem of error messages. BASIC isn't good with errors. If an error occurs and there is no provision for error handling in the program, then execution of the program terminates and a cryptic error message, like OUT OF DATA IN 200, is displayed on the screen. If you wrote the program, that's probably OK, because you can go to line 200 in the program, list the line, find out what the problem really is (what the computer says it is, is usually just the symptom) and fix it. If you didn't write the program, you have no idea of the nature of the problem, and trying to find it could try your patience.

There has to be some error-

handling capability in a program like Desk Master. BASIC has a command called ONERR that will be executed if an error condition occurs that would otherwise cause execution to be halted. I had to put the statement in as the first statement of all the programs in Desk Master. In the calculator subprogram, for example, it's line 5.

5 ONERR GOTO 30000

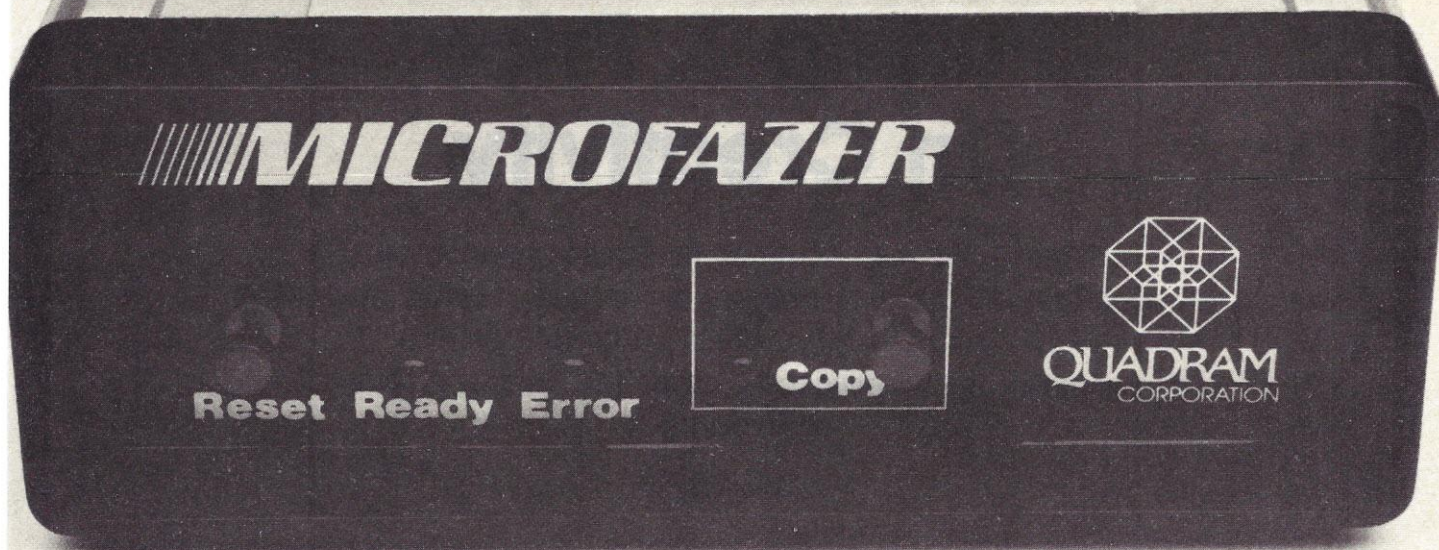
The ONERR GOTO 30000 command tells the computer that if it encounters an error condition, it should go to line 30000 and do what it's told to do there. Here's my error-handling routine for an Apple II:

```
30000 REM ***** ERROR
      ROUTINE *****
30010 ER = PEEK (222)
30014 ER$ = "DISK"
30015 IF ER = 0 OR ER > 15
      THEN ER$ =
      "COMPUTER"
30020 IF ER$ = "DISK" THEN
      PRINT "DISK ERROR.
      MAKE SURE THE
      PROGRAM DISK": PRINT
      "IS IN THE DISK DRIVE,
      AND RE-BOOT.": STOP
30025 IF ER$ = "COMPUTER"
      THEN ME$ = "MATH
      ERROR"
30030 IF ER (<>) 22 THEN
      POP: GOTO 30030
30040 GOTO 300
```

Well, that's Desk Master. I've tried to tell you what I felt as I was writing it. Like any program, it started as an idea. It progressed through the conceptual stage, to coding, to testing. It isn't perfect—no program ever is. There are ways that it could be speeded up. It could be a lot more sophisticated. It could have more functions, like exponentiation in the calculator subprogram or character editing instead of line editing in the memo writer. If you decide to implement these other functions, write to me in care of *Personal Computing* to let me know how it went.

Good luck with Desk Master. 

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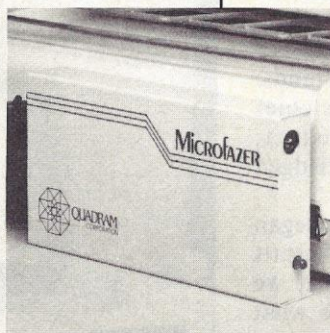
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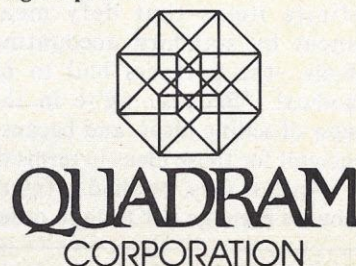
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Putting A Price On Creativity

Bright ideas can produce profitable results, but costing out the idea process is complex. Here's how one firm—using a personal computer—is generating the necessary data, and saving money while doing it

by John Rymer

Five years ago, when a group of employees bought a piece of the New Jersey company they worked for, they knew generally what they wanted it to become, but they didn't know just how they were going to get it there.

The property they bought was the design arm of Einson Freeman & Detroy Corp., which was an established printer and manufacturer of product display boxes and stands. The new owners, under the chief operating officer, Jan Anstatt, planned to turn it into a full-fledged promotional agency.

"In the first year, 1978, we began to untangle what we were," Anstatt recalls. "We had to know what we were before we could become what we wanted to be." And since the company planned to become a business built on creative talent and ideas— indefinite items that defy measurement by standard accounting methods—the partners had to be methodical. "Because we're in the business of selling ideas, and because we account for those ideas in terms of time," Anstatt says, "we had to figure out how to manage our time in order

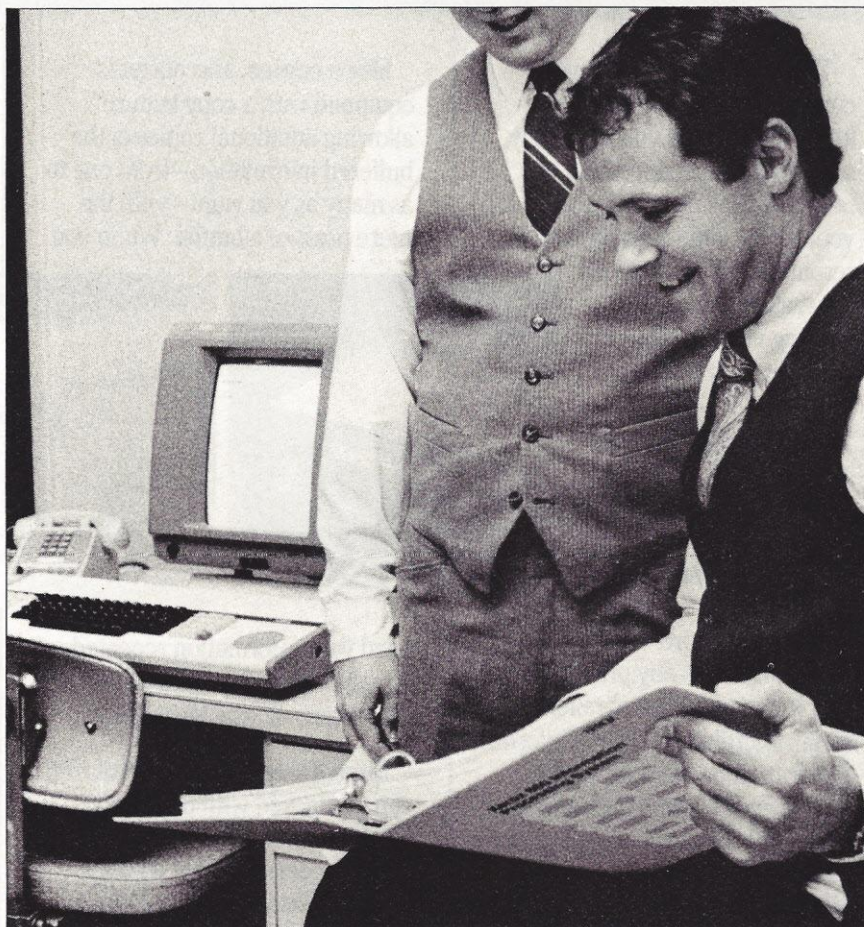


photo by Werner Wolff/Black Star

John Rymer is a free-lance writer from northern New Jersey who writes on a variety of topics.

Jan Anstatt and William Horne developed a creative formula that includes job-costing equations in order to make intelligent decisions about present business while still keeping an eye toward the future. They know that even in creative work, time is money.

to be successful." In sum, the new owners realized that time is money. They had to make their time work for them.

William Horne, the company controller, and Richard F. Lane, of the accounting firm Schierloh and Lane in Paramus, N.J., began the task of analyzing the accounting system inherited by the new owners. Horne was already dissatisfied with the system and was considering a change.

Einson Freeman's major reports were being generated by two computing companies, AIM Inc. and Automated Financial Systems, both New Jersey-based companies. AIM did the firm's payables and receivables reports and compiled what Lane called a "cash-requirements" statement. Those data, in turn, were sent to Automated, which produced Einson Freeman's general ledger once a month.

It was a cumbersome, inflexible and expensive system designed to serve the needs of a large corporate structure, says Lane, but Einson Freeman was no longer a subsidiary of EAC Industries, Inc., the mini-conglomerate that had owned Einson Freeman & Detroy Corp. Bookkeeping mistakes were a continuing problem, and they symbolized the firm's lack of control over its own accounting system. The computer simply could not accept the corrections until after its initial run was complete.

"We input accounting data twice a month," Horne recalls. "If we made a mistake, it was two to four weeks before we could get it corrected."

"Einson Freeman didn't even have a terminal in its offices," adds Lane. "The people there were always working with old information."

Back to manual accounting

They decided quickly that Einson Freeman relied much too strongly on mainframe time-sharing bureaus for accounting. So they went back to the basics—to manual bookkeeping.



photo by Werner Wolff/Black Star

When the Anstatt group took over, Einson Freeman employees relied too heavily on time-sharing for their accounting. When they went back to basics—to manual bookkeeping—they were paving the way back to computers.

And although they were not aware of it then, this action actually paved the way to a return to computers—but this time, personal machines.

The move back to manual accounting began about eight months after the Anstatt group took over. The receivables accounts were the first to come off the computer. Horne put them on the One-Write system, a check-writing and accounts-receivable system by Safeguard, located in Lansdale, Pa., which enabled him to restructure the bookkeeping reports. AIM had required Einson Freeman to provide 60 often meaningless categories of data, he says. With the manual system, the number of categories was reduced to 30.

"By going manual we had current information all the time. We could

generate receivables reports in two days, which put us ahead of the old time-sharing system by seven to 10 days," says Horne. The general ledger was switched to the same manual system three months later; payables followed within two months. And because the manual forms were simpler, the bookkeeping staff was reduced from three to two.

Job costing turns the tide

As Horne and Lane began to redesign the company's accounting systems from time-sharing to manual, one report—job costing—continued to pose problems. Although the time-sharing method of estimating and tracking project costs was totally inadequate, there was no easy way to do it manually.

When Einson Freeman was only a

They couldn't have known it at the time, but going manual actually paved the way to getting back into computers.



Photo by Werner Wolff/Black Star

In the process of coming full circle from a mainframe to manual accounting methods to a personal computer, the employees of Einson Freeman believe that personal computers are as much a preparation for the future as they are a response to today's needs.

designer of point-of-sale displays, job costing was relatively simple, says Horne. Creative directors compiled their estimates by adding the cost of materials plus the time it would take to put a project together. Because projects usually were not very kinetic, variations on these costs were few and therefore easy to control.

But Einson Freeman was becoming the full-fledged promotional agency Anstatt and his partners hoped it would be. By mid-1981 its staff of 30 and its team of free-lance artists were designing and producing contests, posters, point-of-purchase displays and entire sales campaigns that combined a wide range of marketing techniques for Thomas' English Muffins, Pepsi Cola and other equally well-known products.

The creative staff was increasingly

called upon to design full-blown marketing campaigns. In 1978, 5 percent of Einson Freeman's time had been devoted to these large undertakings. By 1981, the percentage had quintupled and was still on the rise. An expanded number of tasks was necessary to complete these projects, and the company often charged a different hourly rate for each one. Moreover, the mix of materials and creative talent changed each time out. Clearly, Horne says, Einson Freeman needed a system that could segregate and measure the individual costs involved in each project.

"In the beginning, the money was pouring in, and we didn't pay much attention to this whole problem," says Horne. "But then we said, 'Maybe we could do better if we really knew what we were doing.'"

"Although creativity itself is not quantifiable, except in terms of value and effort," Anstatt says, "we realized that it is possible to quantify the various functions that go into a creative effort, such as design, graphics, illustration, copywriting, mechanicals, type specing, coordination and so forth. We decided that we had to break down the aspects of the creative process in order to better account for our time in job costing, so that we could become a viable profit center."

It was then that Anstatt and Horne developed a creative formula, which includes job-costing equations for everything from design supervision, to illustration, to photo direction.

An eye toward the future

The company hopes to isolate and analyze accumulated information in a variety of ways: by function (mechanicals, for example), by creative director, by industry and so forth. In this way, they can review each function over time, such as time spent on mechanicals, in order to make intelligent decisions about staffing as well as pricing for future projects. And the creative directors will be able to check their initial estimates for time spent on various aspects of a project against the actual time the tasks took—this in an effort to sharpen their job-cost estimating and planning skills. In addition, reviewing projects by industry—liquor, health and beauty aids, and so on—can provide management with an overview of past projects with an eye toward the future.

Tracking is another management goal. Once a job is in the works, the company hopes to be able to check its progress. If, for example, a job was estimated to require 50 hours of mechanicals work and half the time allotted is gone, management would like to check to see if, indeed, half the job is also done. If it is not, then the company can use that information to plan for additional help that might be

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CIRCLE 38



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"The 'big-brother syndrome' could be dangerous if we use the computer to make judgments rather than to help a person improve."

needed for upcoming projects, and the data can be used to help the firm in future estimates.

The complexity of the creative-time breakdown and tracking needs made recomputerization inevitable, says accountant Lane. To accomplish this, he says, Einson Freeman needed both speed and the flexibility to improvise that no mainframe service can provide.

And Anstatt adds: "If we want to process data and look at it six different ways from Sunday, we'd need six times more hands to do it manually. Because of the flexibility that is needed, we wouldn't be able to do it on a mainframe. The other alternative—the one we chose—was the personal computer."

Researching personal computers

This led Horne and Anstatt to look at the personal-computer marketplace. They found, ironically, that by going to a manual system, they were already one step up the ladder to their purchase. Because they knew what kind of reports they wanted, they had only to locate the software that could produce those reports and then buy the computer that could run the software. Since they also wanted to have a system that could do general business functions, though, they hoped they could find one program that would do it all.

Horne and Anstatt dove into computer shopping with spirit. They talked to everyone they knew who owned a personal computer; they sought the advice of friends who own computer stores; they read computer magazines; and they attended seminars on how small businesses can put personal computers to work.

In April 1982, Einson Freeman hired Compro Resources, Inc., a Monroe, Conn., computer-consulting firm, to help find the right system. Compro's president, Bill Flynn, took Anstatt's many requirements—from general business functions, to creative-time breakdowns, to job

estimating—into account, reviewed the software available that appeared to meet those needs most closely and then chose hardware that would support the operating system that most of the applicable software runs on. He settled on the Altos BI 280 by Altos, in San Jose, Calif.

The next step was to choose the Altos Accountant software package, which is a general business system that contains a job-cost module within it. Flynn's feeling was that this software would provide all the general business functions required by Einson Freeman, and that the job-cost module might cover Anstatt's intricate job-costing requirements, including the various creative-time breakdowns and the tracking potential. His intention was to recommend a relational data-base management system that could be individualized for the company in the event that the Altos Accountant package would not provide adequate flexibility. First, though, he felt that exploring the full potential of the "off-the-shelf" package was worth a try.

As predicted, the software met Einson Freeman's general business functions, but it did not allow the detail Anstatt requires for the job-costing function. According to Flynn, "As systems become more general in nature, it becomes harder to have those systems meet every individual's needs. One set of software on one set of hardware will not do everything for everybody. It is often necessary today to get application generators or relational data-base management systems—preferably English-language systems—that permit ultimate individuality by allowing the user to create the system for himself, to create his own forms and to update them as he wishes. But defining minimum and maximum requirements and trying to make an existing system work for you is a good way to go."


When the Altos BI 280 goes on line next month, it will be ready to tackle the important accounting

functions—receivables, payables and general ledger—as well as the first line of the crucial creative job-costing reports. "Right now the software can give us an overall summary of the costs of our creative time on each project," Horne says. "Once we're on line, we'll further explore whether the software can give us cost breakdowns of each individual creative category, as well as a tracking potential. If not, we'll move to a relational data-base management system."

The Altos system costs just over \$14,000, with \$2500 of that going toward software. The addition of a relational data-base management system could add from \$300 to \$1000. Even with that, the savings over the old system are substantial, since Horne was able to reduce his staff to a single clerk. By comparison, the computer-service bureaus cost \$600 a month plus three salaries.

The future with "big brother"

Anstatt enthusiastically touts the new system. He believes it will be a valuable management tool for his creative directors. But he concedes that the concept of "the big-brother syndrome" is something to be concerned about. "It will depend on how the information is used," he says. "If we use it to draw conclusions in isolation and put a price on a particular person's creativity, that's dangerous. But if we use it to constructively encourage and help a person improve, I don't think we'll have problems. Basically, most people want to do a good job, and they want to do a better job tomorrow than they did today."

In the process of coming full circle from mainframe to manual to personal computer, a wider, more creative vision of the future has emerged at Einson Freeman. "These computers are as much preparation for the future as they are a response to our needs today," Anstatt says. "I believe that 10 years out, in every business, 90 percent of the people will have personal computers." 

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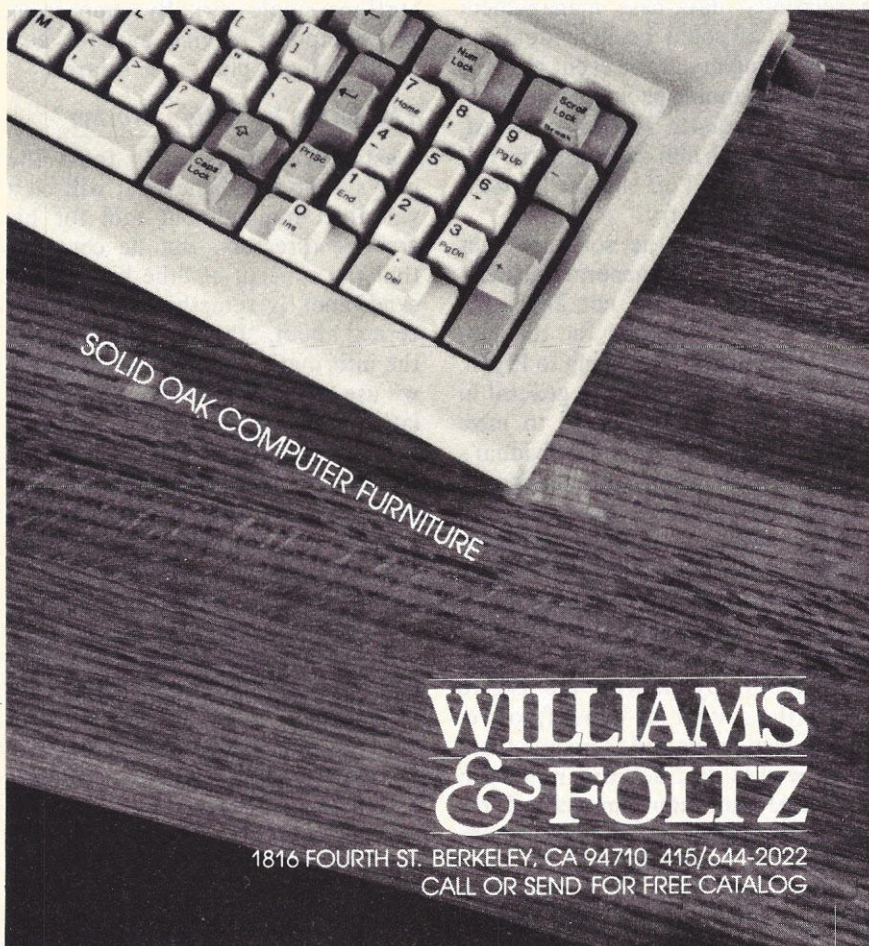
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CIRCLE 61

COMING IN FUTURE ISSUES

Drawing The Line

Computer graphics—a maze for the uninitiated... or is it? February's cover story explodes the myth that graphics on a computer are not for the faint of heart. We'll plot a course that will lead you to simple, easy-to-use ways to put this exciting tool to work—and in the process, you'll learn to draw yourself a better bottom line.

Damage Control

What happens to your hardware and software in the event of a fire? The question is: Is anything salvageable? There are some surprising answers in this story, answers that will give you valuable tips about what to do in case the unthinkable happens to you.

Rural Compute

The Renaissance man—aloof, self-sufficient, independent. It's a kind of life that seems all but impossible in our super-heated, hi-tech society. But one man is proving that it is precisely because of hi-tech that it's again possible to live out of the mainstream. It's one man's dream come true—and perhaps, a road map for others who have looked longingly at the woods.

Software From Scratch

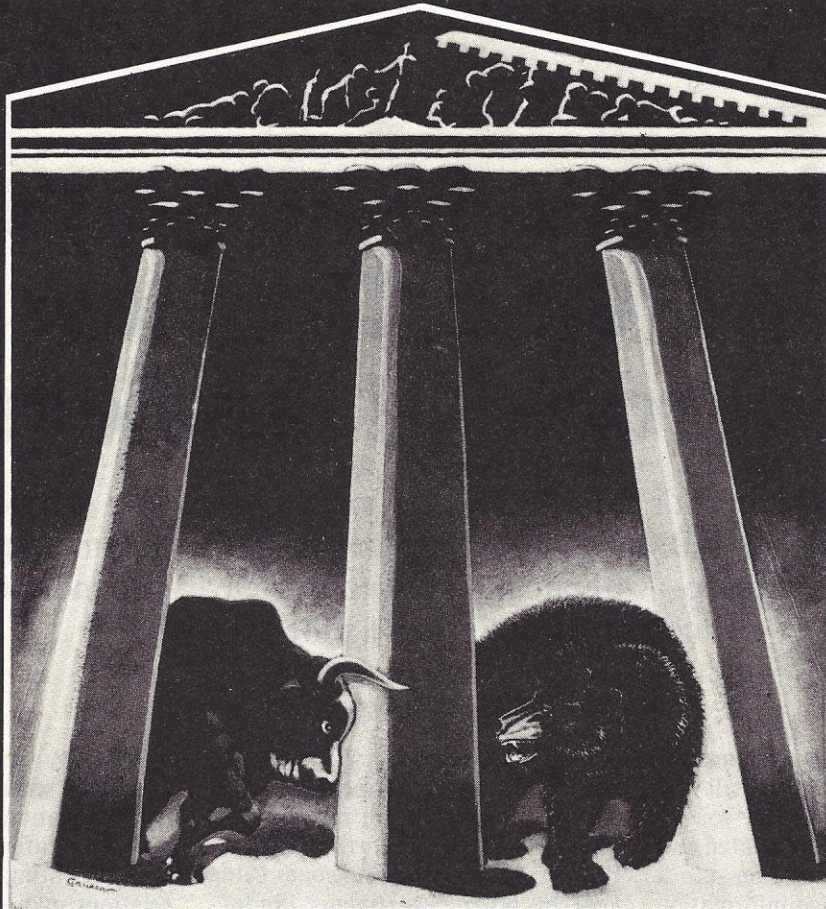
Have you ever wondered who designs the software packages for your personal computer? Where they get the ideas—how they do it? Our story begins at the beginning and traces the birth and development of one software package from its initial design to the moment it lands on your dealer's shelf. If you've ever thought about writing software, this is an article you won't want to miss.

Dating The World

There's a group of geophysicists at Lamont-Doherty Geological Observatory in Palisades, N.Y., who, with one Apple, are dating the magnetic history of the planet. Their work, made possible by the mating of a personal computer to a state-of-the-art magnetometer, will extend our understanding of the earth's past, back half a billion years!

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CIRCLE 49

Data-Base Management Systems: The New Bedrock Of Business

Whether it's a full-scale relational system or a simple filer, a DBMS gives you instant access to a complete data bank—without the need to maneuver around the corporate mainframe time schedule

by Barbara Schwartz

A good data-base management system, or DBMS, after all the trimmings are removed, lets you do three basic things: collect related and diverse pieces of information into a central pool, reorder that information almost any way the mood moves you and get back the product of that reordering in a form you can use.

Take the case of the company that wants an alphabetical listing of all its sales representatives east of the Rockies who are drawing over \$5000 per month. At the same time, the marketing department wants to send sales fliers to male customers between the ages of 50 and 51 who live in Indiana, but none to its customers in Illinois. Both needs can be handled by simply keying English-like sentences into a personal computer. The data-base management system is booted up, and in a relatively short period of time, it has finished both jobs. In fact, it's no big deal.

Data-base management systems have been around awhile—since the days when big companies were locked into mainframes for almost everything. DBMSs were created to take

care of the problems created by the need for each department within a company to keep a set of tapes and disks. The catch-22 in this was that the records were the same ones being kept by other departments. Redundancy reigned.

The idea was to put together a program that would centralize all of the company's important records and data. That way, the company would be freed from playing caretaker to vast amounts of tapes and disks—items which, as every manager knows, have a way of multiplying faster than hangers in a closet.

The DBMS could take care of the problems of redundancy of data and allow the various users of that data easy access to a whole pool of other information. Using a DBMS, for example, Joseph Smith's social security and pay classification numbers could both be part of his personnel file—which could be routinely dumped into the corporate mainframe. Then, if the accounting chief needed Smith's payroll or social security number, he could access it through his office terminal. He would not have to have his own copies, which represented a tremendous savings in terms of space—to say nothing at all about the headaches caused by a lost file.

Not only was the problem of storage space solved, but the company's human relations officer could also access that information—and neither the accounting chief nor the human relations man would have to keep a separate set of tapes and disks. In fact, since the file on Smith had been centralized, anyone with a need to see a complete file on him could get it from the company's mainframe storage without having to plow through the various departments to compile the information.

But another problem surfaced. With all the data stored on the mainframe, the managers found themselves cooling their heels at the computer-room door waiting to get their data requests. Turnaround time became a serious problem.

The answer came with the widespread use of personal computers for everything from full-scale book-keeping to long-range business forecasting through fast-speed management. Managers could keep their own data and files on disks—and access them any time they wanted to, without the problems of storage. With data-base management systems, they could also manipulate those data any way they needed to without hav-

(continued on page 153)

Barbara Schwartz is a New York-based computer consultant, teacher and writer.



Illustration by Dave Pauley



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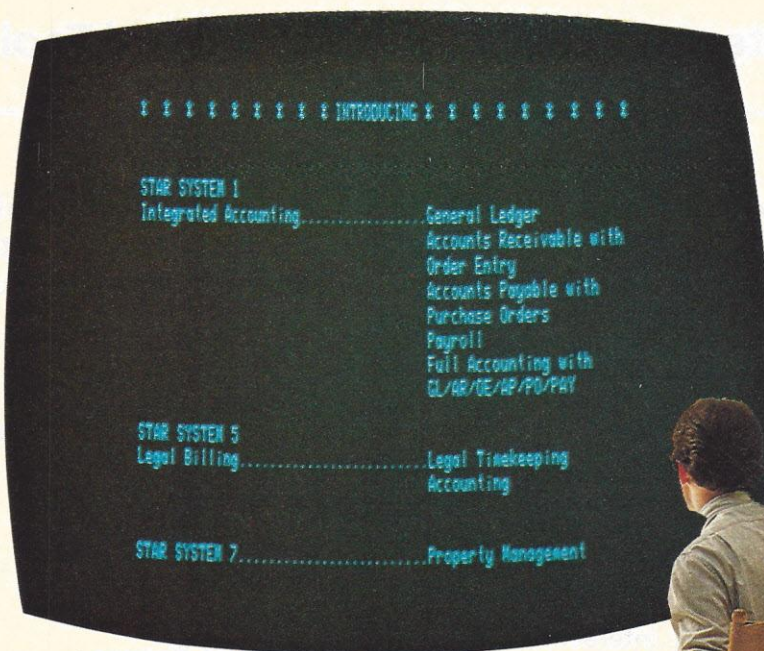
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CIRCLE 51



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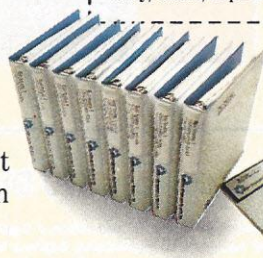
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CIRCLE 52

Relational systems have the ability to attack complex data-management structures and go through them like Grant went through Richmond.

DATA-BASE MANAGEMENT

(continued from page 148)

ing to wait in line for the mainframe to free up. Now, the DBMS has become one of the bedrocks of personal-computer use in business.

There are a lot of variations on data-base management, and there is some question as to whether or not various programs qualify. But a program must have at least two basic functions to qualify as a real dyed-in-the-wool DBMS: the filing system and the relational system.

Simply described, the filing system is nothing more—but certainly no less—than a computerized version of the old metal cabinet—and it's the most basic form of data management. Each data file that has to be kept, whether a sales representative's performance record or the number of products manufactured each month during a full moon, is put on a separate computer disk. The data are retrieved by calling up any of the variables on the file. A good example of the kind of variables used would be a sales representative's name or a product number.

It's an easy and convenient way to manage data, and one currently favored by a growing number of personal-computer users. But it has its limitations. If you use the filing system alone, you can't compare or manipulate information contained on separate data disks. Because of that limitation, purists maintain that a filing system is not a DBMS in the true sense of the word.

But there is a way to solve that problem, from a user's or a purist's point of view, and that way is found by using a relational system.

Relational systems have the ability to attack extremely complex data-management structures—and, as they say, go through them like Grant went through Richmond. They simply take information from each of the individual files and dump it into one huge data base. Then, in response to such plain-English commands as

DISPLAY, LIST and USE, they combine select portions of the information into any kind of a report that happens to be needed. In short, a relational system gives the user a programming command language to manage large data bases on a personal computer.

Consider the basics

Whether you opt for the high road or the low road, the steps involved in setting up and running a DBMS are basically the same. If you're at the stage of your game where you're just about to make a purchase of a data-base management system, you'd be well advised to have some answers about your business needs. It's those answers that will tell you exactly which way to go.

Among the questions you'll need to answer, to shop intelligently for a DBMS, are:

- How much data do I have?
- What kinds of data do I want to manage (numeric, alphabetical, formulaic)?
- How complicated are the different forms that I want to use when I need the data? Will they require elaborate printouts, averages, medians? Will a simple listing do the job?
- How much time am I willing to spend to learn a new data-base management system? The filing system? (The filing system is the simpler of the two and easier to learn; relational data-base software can require significant chunks of time and effort.)

Choosing the simple filer

John Stewart, owner of Rockville Instant Printing and chairman of the board of the National Association of Quick Printing, bought a filing system called PFS from Software Publishing Corporation in Mountain View, Calif. Along with it, he brought home PFS' companion program, PFS: Report. The two programs, he was convinced, would go a long way toward making life easier under both of the hats he wears.

Under his Rockville owner's hat, he uses the PFS to monitor the production pace of his press operators.

According to Stewart, "The pressmen keep a one-page report that details the progress of their work each day. Once a month I take the information from the 160 and 180 reports that the pressmen have turned in and put it on a form I designed on PFS."

Then, Stewart continues, he enters the data and loads the PFS: Report. From there, (I get) "...a monthly production report on each pressman. This report is then turned over to each to tell him how he's done for the month and how his work output compares with previous months."

At the Quick Printing Association, where he wears the hat of chairman of the board, Stewart uses PFS as a kind of market and professional surveyor.

"We send out marketing questionnaires with some suggested responses," Stewart explains. "For instance, we might ask our members to list the three basic areas of their businesses—quality, speed and price—in order of importance to them. Or we might include a survey question that asks for the going prices of products like 20-pound bond paper or three-pound carbonless paper—and ask them to separate the price quotations into four different quantities. When I get the questionnaire back and input the answers on PFS, I'm able to compile reports like the average price for 20-pound bond by region, by franchise, by independent supplier, by size of order and so on."

"Or," Stewart continues, "I can produce a report that describes the emphasis our printer members put on quality, speed or price in each segment of the country. Then the results are printed in the *QP Quarterly*, a quarterly newspaper about economic trends and indicators in the printing industry."

Stewart's choice of PFS was a fairly painless one. He needed a simple

"A good DBMS could be the threshold that takes the personal computer from a tool that was dispensable to one that is indispensable."

and inexpensive data-base management system, a filing system, that could take a large number of variables from a central form—the Association's questionnaire in the one case, or the pressmens' daily reports in the other—and sort them out to produce organized and clean reports.

A quick count

For Richard Schweitzer, another data-base management system user, the choice of which DBMS to use was far more complicated. Schweitzer, owner of Sammamish Data Systems in Bellevue, Wash., was looking for software that could be the foundation for a wide-ranging data base built around the 1980 United States Census. He intended to market an integrated computer system—hardware, software and peripherals—for real-estate developers, political researchers and social analysts. The idea was to provide these special users with quick access to the region's census data.

"A developer may," Schweitzer explains, "decide to build a shopping center in a specific area of our region, but before he proceeds with his plans, he'll want to know how many shoppers live within five miles of the store, how old these shoppers are, what their income levels are, etc. And when the shopping center is built, national retail companies, thinking of locating there, will need the same kind of information."

To provide answers to these user-specific questions, Schweitzer developed a computer system using the Zenith Z-90 hardware. To duplicate that system at retail would cost over \$10,000, but it can handle the massive census data base he needs—and output individual demographical records in less than 10 seconds.

"Previously, my customers would have to go to a national time-sharing service that handled demographics analyses to get this kind of information," Schweitzer says. "And then they still had to wait a few weeks to

receive their data. If the right questions were not asked up front, which happens a lot, the data they received obviously didn't mean much. But with my system, they can sit down at their own terminals and reason through a lot of different options."

Organizing the range of statistics that come from a census report into a compact data base—and making these statistics available in almost any report form immediately—required the use of a very sophisticated relational DBMS. Schweitzer's choice was dBase II, made by Ashton-Tate, Inc. of Culver City, Calif.

As fast as the disk can spin

Schweitzer points out that dBase II is a relational system that jumps to a given record in record time—essentially, as fast as the disk will spin. "If one of my customers wants to get census information on a specific area of San Francisco, for instance, all he has to do is type into the computer a statement called GOTO and the data-management system will jump right to San Francisco, cutting across all the other data getting there. If he was using a simple data filing system," Schweitzer goes on, "it would take a minimum of a couple of seconds to search each sector of the data-base structure and pass through every level of geography before getting to San Francisco. From there the DBMS might have to go through as many as 13 additional levels of information as it tries to pull out the ages, incomes, purchasing power, etc., of the people of the region."

Although Schweitzer and Stewart represent two DBMS success stories, most users admit that they do make mistakes. One of the more common is to try to duplicate the forms that are part of the manual system onto the DBMS.

Tom Vogel, library director of the Philadelphia College of Textiles and Science, attempted to design a book catalog using PFS in just this way.

The first results were far from satisfactory. The big problem was that, since PFS is not a relational system, it couldn't jump over unneeded information to retrieve the data he asked for.

"We started out by using our old forms to keep records of books we were acquiring and which ones we already had," Vogel remembers. "So we typed our form into the computer—author first, then the title, then the publisher, then the publication date, etc., just as it appeared on our existing paper files. But we realized that for PFS it would make more sense for us to place the title first, because usually, when we look for information on a book, we search by title and not by author." And, as Vogel found, a filing system like PFS can get to information quickest if it is located in the primary category on the form.

John Stewart adds: "If you have 300 or 400 entries to go through and the information you're searching for is part of the first category on your data form, the computer can go through the 400 files in one and one-half to two minutes. But if you're looking for information that is listed in your third or fourth category, you have to figure it could take as long as 10 minutes to find what you need."

Similar problems will not arise with the relational data base—quick information searches are its forte—but some users get hung up by its sometimes complicated language. While most of the simple filing systems are menu-driven by number commands, the relational data bases rely on programming terminology to the point that if the computer is directed down the wrong avenue by directions, the data could remain hidden on some dead-end street for a long time.

But whether the choice is a relational system or a simple filing program, the classic computer admonition, "Read the manual carefully," applies. Tom Vogel recalls: "In the

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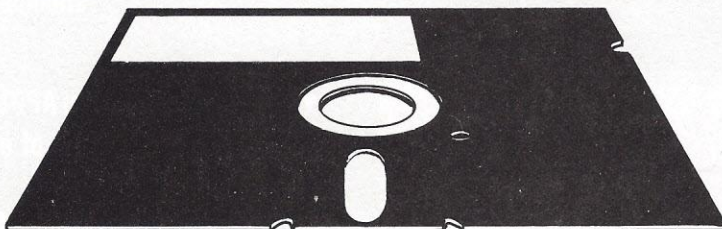
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first edition of PFS, when you set the program to print, you had to tell it to automatically advance the printer; otherwise it wouldn't. But try to find this regulation anywhere in the manual. It's nearly impossible. So I didn't tell the computer to advance the printer, and the printer ended up typing everything on the same line, with each line of the report being typed right over the line before. I finally found an obscure reference in the manual to what I did wrong. The problem was that I hadn't read the manual as clearly as I thought I had."

All of these problems are, of course, relative. Those who were previously saddled with attempting to keep information in an overstuffed filing cabinet—where after a period the mass of paper forms were often torn or lost—stress that any complaints with the DBMS smack of looking a gift horse in the mouth. Once the computer smoothly presents the data you're looking for in a matter of seconds, the nightmare memories of the old office filing cabinet are gratefully buried—and any ungrateful remarks about the DBMS are forgotten.

Is it worth it?

Still, it takes a certain amount of discipline and hard decision making to purchase the right DBMS and to use it correctly. To most users, apparently, the effort is worth it.

John Vogel notes that "before we had the system, it was almost impossible for us to revise our book catalog, especially to drop some new information into it. And we could never access the catalog from the wide variety of categories that we can with the DBMS."

Richard Schweitzer is even more enthusiastic, if only because he couldn't even think about manipulating unruly census statistics without the data-base manager. "To be able to find any demographic record about any region within seconds would have been difficult to do on a

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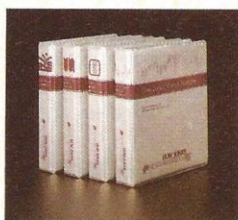
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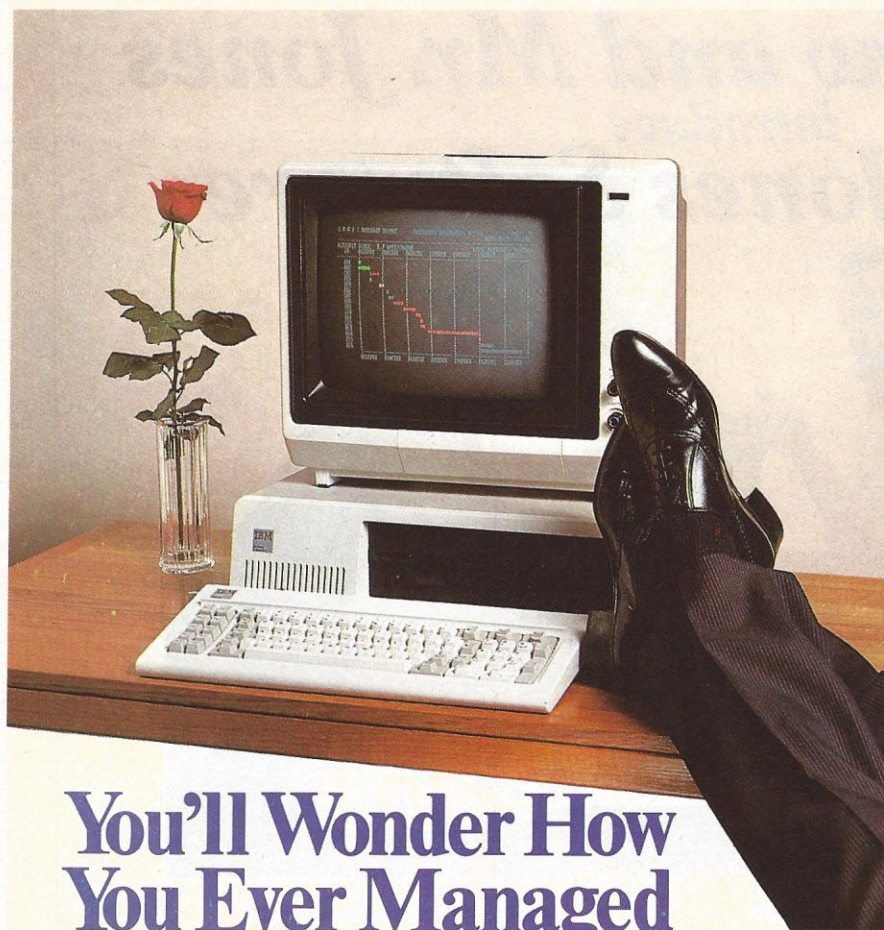
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mainframe just a few years ago. Clearly, the relational DBMS significantly expands the power of the personal computer."

Expanding the machine's power—and, in the process, its organizational accomplishments—has become a byword to many personal-computer users. A good DBMS, one computer industry expert said recently, "could be the threshold that takes the personal computer from a tool that was handy, but dispensable, to one that is indispensable." 

GEMS OF WISDOM

Preventing An Apple Crash

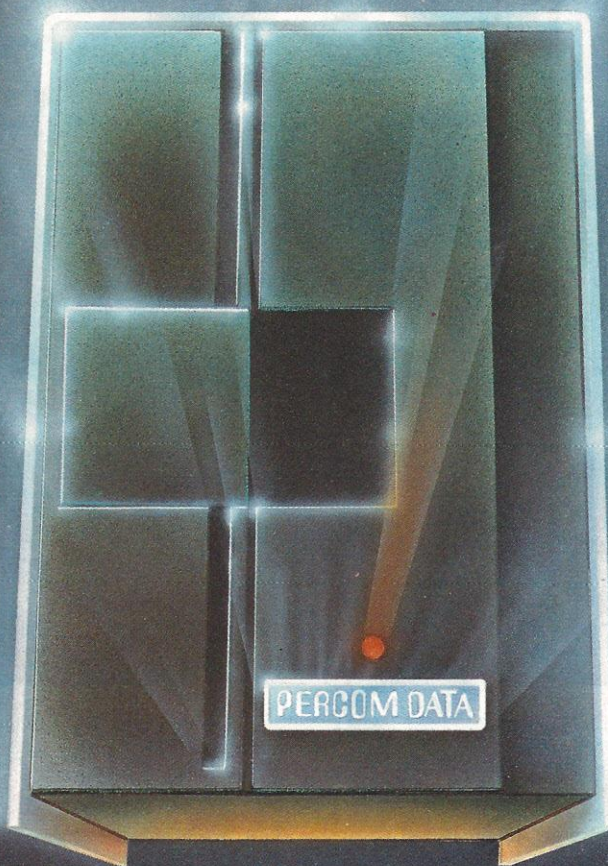
In the book, *Apple BASIC: Data File Programming, A Self Teaching Guide*, by Finkel and Brown, the ONERR GOTO command is used to detect the end of data when reading a data file. However, after reading about 10 files your program will crash with an ?OUT OF MEMORY error displayed on the screen.

The solution is buried in the Applesoft BASIC manual. Write a BASIC statement early in your program as follows: (line number) POKE 768, 104: POKE 769, 168: POKE 770, 104: POKE 771, 166: POKE 772, 223: POKE 773, 154: POKE 774, 72: POKE 775, 152: POKE 776, 72: POKE 777, 96.

Now, follow each ONERR GOTO statement with a CALL 768. This runs the above machine language routine, which fixes whatever is upsetting your Apple II computer.

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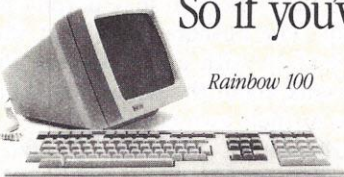
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BOOK REVIEWS

What Parents And Teachers Should Know About Computers In The Classroom

PRACTICAL GUIDE TO COMPUTERS IN EDUCATION

PETER COBURN ET AL
ADDISON-WESLEY PUB. CO. INC.
READING, MA
266 pp., \$9.95

A few months ago, I was asked to join a town committee charged with the job of recommending the purchase of personal computers for the local elementary and junior high schools. The committee consisted of a cross section of interested teachers and parents plus a few experts, in which category I modestly placed myself. I wish I had read this book before the committee started its deliberations and, had I done so, I would have gladly given copies of it to each member of the committee.

Although the process of computer selection was not complex or arduous, much of the time in the meetings was spent educating committee members in hardware, software and classroom applications to enable them to come to a sound purchasing decision. This guide would have cut the committee's time in half. Any educator who is using or contemplating the use of computers in the classroom should have a copy of this book.

This guide is also recommended to parents. The book won't tell parents how to use their personal computers for computer education in the home, but it will enable them to look critically at their local school systems' computer usage and to make sure that computing literacy has its proper place in an up-to-date curriculum.

Practical Guide to Computers in Education is the basic primer in a series under development for Addison-Wesley by a non-profit group of educators and editors called Intentional Educations, Inc. The group not only creates textbooks, but it produces educational software for schools and support materials for teachers. The authors assume no computer knowledge on the part of the reader but proceed at a brisk, no-nonsense pace and impart a lot of useful information.

The book begins with a few tales, clearly drawn from the authors' own experiences, of good and bad uses of computers in schools. The authors raise a number of fundamental questions that are answered later in the book, which is one of the guide's appeals.

The book is not a tutorial from the "Dick and Jane Use Computers" school. The authors know that they are dealing with adult readers who can think about the issues raised and come to their own conclusions.

Subsequent chapters overview classroom applications and provide an excellent introduction to hardware and software. Two chapters on choosing computer systems and educational software would have been extremely useful to our committee and should be mandatory reading for educators contemplating computer purchases.

Parents will find Chapter 6, "Introducing Computers into the School," particularly valuable. This chapter includes the politics of computer acquisition, school funding and the preparation of teachers and ad-

ministrators for computers in the schools. In these days of tightened school budgets, this chapter should help parents discuss effective computer usage with school boards and teachers.

The final chapter in the guide is about current trends in educational computing with a quick look at three leading educational researchers: Patrick Suppes of Stanford, Arthur Luehrmann of Dartmouth College and Seymour Papert of MIT. In this chapter the authors also pose a number of future questions including the possibility that computer/communication systems may eventually make schools irrelevant. While the authors do not espouse that particular view, it's clear that the advent of inexpensive personal computers and sophisticated communications will mean that the ideas of such people as Suppes, Luehrmann and Papert will more easily find their way into school curricula.

If this guide piques reader interest in new ideas about computers in schools, I would suggest reading *The Computer in the School*, edited by Robert Taylor and published by the Teachers' College Press of Columbia University.

—Jeffrey Bairstow

Plans for software success

A GUIDE FOR SOFTWARE ENTREPRENEURS

A.L. FRANK
PRENTICE-HALL
ENGLEWOOD CLIFFS, NJ
190 pp., \$29

On the first page of his book, A.L. Frank offers this fundamental rule: "All efforts in a software business should be directed at generating a profit." *A Guide For Software Entrepreneurs* thus focuses on the

major and minor details involved in organizing and running a profitable software business, not the technical side of software.

The author explores the many factors to consider before starting a firm, such as choosing a good lawyer, accountant and banker; doing financial planning; obtaining office space; hiring sales representatives; planning a product; and developing a marketing strategy.

In discussing the many legal issues to consider, Frank warns readers never to use their employers' facilities for their own ventures, even if they have written permission. Why? Because in most cases an employer who can show use of his facilities to develop a product "may have a valid ownership interest in your product." To avoid this possible conflict and others, the author provides some easy-to-follow guidelines for choosing a lawyer.

Frank suggests choosing an attorney who is a member of either the Computer Law Association or the American Bar Association's subcommittee on computer law. These lawyers, he feels, are more likely to keep current on the constantly changing field of computer law.

Frank devotes much of his book to the need for proper planning in all areas of the business. He characterizes jumping into the software business without thorough and proper planning as reckless gambling. "Unless you are committed to planning," he writes, "you might as well take your funds and go to the nearest casino—the odds for random success are probably better there than in a software venture. With planning, the odds of success are really in your favor, and of course, planning is an activity that by its very nature maximizes profit."

A Guide For Software Entrepreneurs is an outstanding book for anyone who wants to start a business. Summing up the qualities Frank believes spell the difference

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BOOK REVIEWS

between success and failure, he writes: "What separates the dreamer from the successful is that while the former may be aware of the potential reward, the latter is willing to take a chance to gain it. While the successful entrepreneur suffers from some fear of failure, he accepts this as part of the effort."

—Roy Katz

A book for kids

WHAT COMPUTERS CAN DO

DONALD D. SPENCER
CAMELOT PUBLISHING CO.
ORMOND BEACH, FL
368 pp., \$12.95

What *Computers Can Do* is described as "Juvenile Literature." Juvenile this book certainly is, but literature it is not. The book appears to be a self-published guide for junior school children. The revised edition of a book originally published in 1977, *What Computers Can Do*, is an uninspired recitation of recycled material, much of which is out of date.

—Jeffrey Bairstow

Tools for designing your own computer games

GOLDEN DELICIOUS GAMES FOR THE APPLE COMPUTER

HOWARD M. FRANKLIN,
JOANNE KOLTNOW AND LEROY FINKEL
JOHN WILEY & SONS
NEW YORK, NY
150 pp., \$12.95

When I first saw this book, I have to admit that my first reaction was, "Who needs another computer games book?" especially one priced at \$12.95 for a mere 150 pages. However, I barely had time to

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BOOK REVIEWS

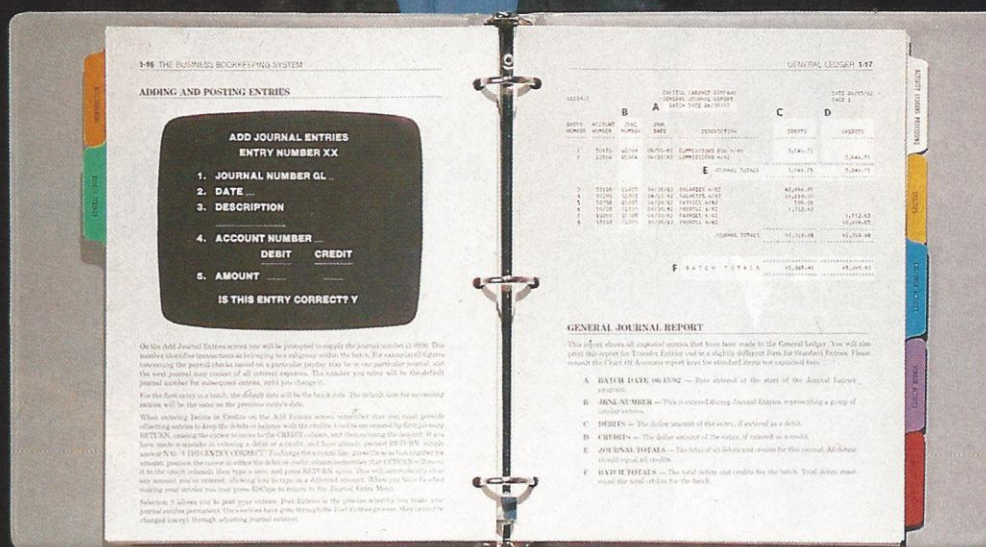
read the book before my 12-year-old son stole it and began to put together his own games.using the authors' suggestions. The proof of these *Golden Delicious Games* lies in the eating, and I'm happy to say I can report at least one satisfied muncher.

If you have a 32k Apple II and a disk drive, I thoroughly recommend that you get this book. Unlike many books in this genre, *Golden Delicious Games* is not merely an assemblage of timeworn game listings developed in the days when hackers used to burn the midnight oil pecking away at the console of a company-owned IBM 360 or DEC PDP10. Franklin and his co-authors have had the good sense to put together a tool kit of routines that can be used to construct a wide range of games.

Although there are plenty of listings in the book, the authors give only six complete game listings and those are presented mainly as examples of the use of routines developed earlier in the book. This book is a fine exposition on the concept of reusable software—it's a library of sub-routines and subprograms that can be used as building blocks for larger programs. These larger programs will take less effort and have fewer errors than programs written from scratch.

The book opens with a chapter on routines for music and other sound effects, followed by a chapter on low-resolution color graphics. The authors show the reader how to combine the sound and graphics routines and cunningly ask little questions that suggest further routine possibilities. This technique is used throughout the book and appears to be an excellent way to encourage reader participation. A third program module deals with data-entry techniques so that a reader who has typed the set of routines will have all the basics for his own games—sound, graphics and data entry.

The listings in the book are in BASIC with some machine-language subroutines (using DATA statements



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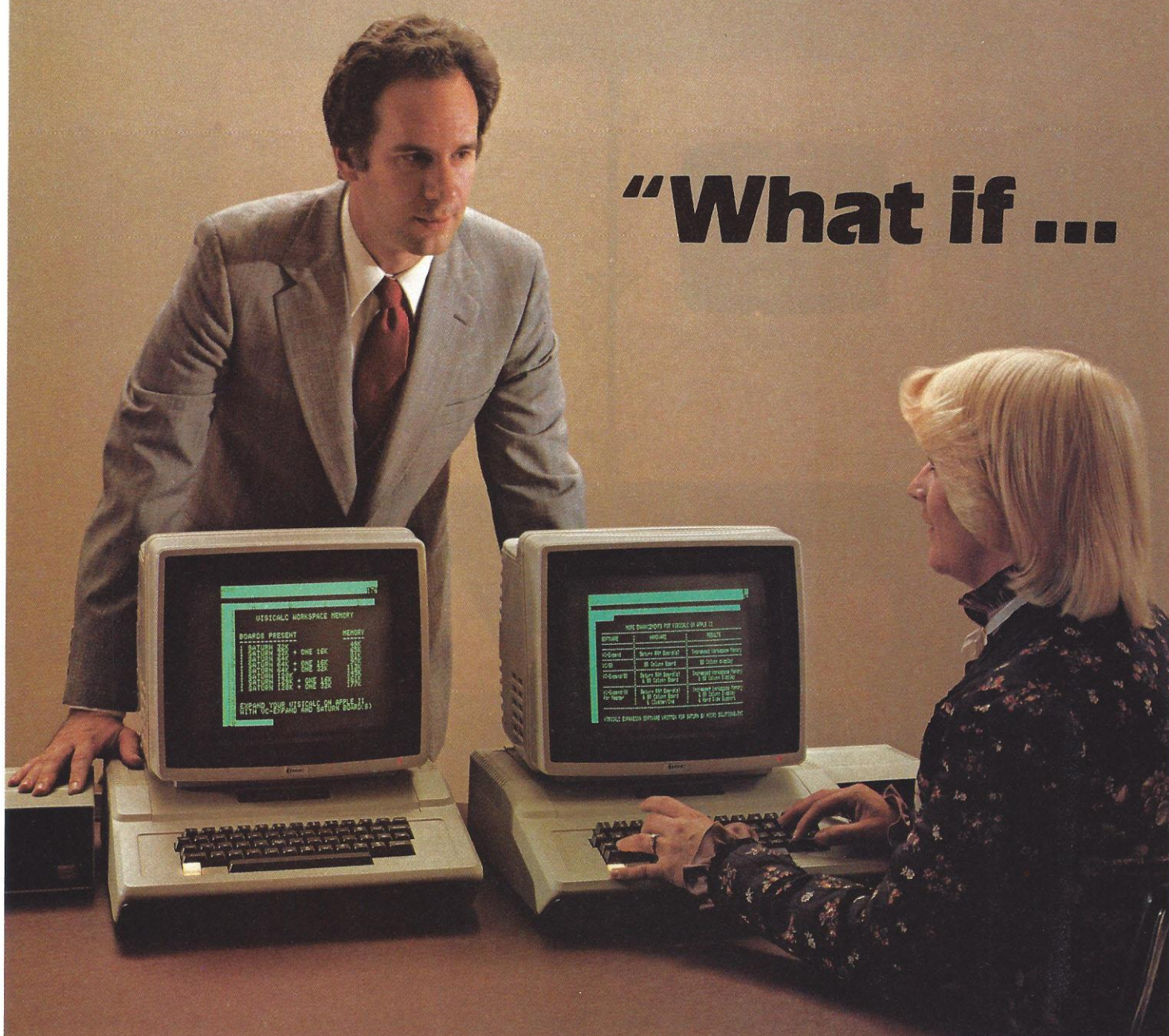
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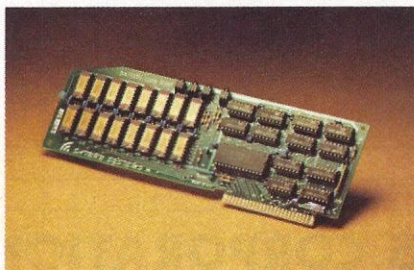
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BOOK REVIEWS

and POKE instructions in BASIC). The programs are numbered in such a way that they can later be merged; an appendix explains how to merge and renumber programs if necessary.

For readers who want to avoid the labor of typing, all the subroutines and the completed game listings in the text are available on two floppy disks sold by the book publisher for \$34.95. However, judging by the experience of my son, I'd say that the serious novice game designer would gain more by working through the text and typing the listings as they occur in the book.

Golden Delicious Games is billed by the publisher as a "Self-Teaching Guide." Because this book is just that, it is enjoyable and useful. I hope the authors will take the time to develop similar books for other personal computers and so educate non-Apple owners, too.

—Jeffrey Bairstow

The world according to IBM

UNDERSTANDING COMPUTERS

MYLES E. WALSH
JOHN WILEY & SONS
NEW YORK, NY
268 pp., \$14.95

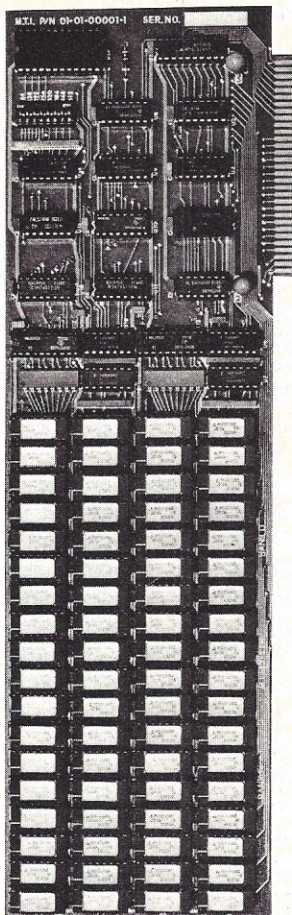
Subtitled "What Managers and Users Need to Know," this book is a guide to the world of computers as seen by a lifelong IBM mainframe user. The book barely admits to the existence of personal computers or, indeed, other computers not made by IBM. The bias is understandable, perhaps, since the author is the director of information systems planning for CBS, the communications conglomerate, a major IBM customer. If your business involves dealing with data-processing managers who operate IBM equipment, this book may have some value.

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BOOK REVIEWS

Reading this book, which is full of acronyms such as DBMS, IOCS, VTAM and the like, reminded me of how much IBM has contributed to the misunderstanding of computers by developing a lexicon of the company's own. Books like *Understanding Computers* are well meant but are so full of jargon that they only serve to turn off the vast majority of managers. It is possible to write about large computers without sounding like an IBM manual. Mr. Walsh has not succeeded.

—Jeffrey Bairstow

People who live in glass houses...

THE NETWORK REVOLUTION: CONFESSIONS OF A COMPUTER SCIENTIST

JACQUES VALLEE
AN/DOR PRESS, INC.
BERKELEY, CA
213 pp., \$7.95

The *Network Revolution* is a thought-provoking, somewhat irreverent book that is sure to generate heated debate among computer scientists, programmers and designers. Jacques Vallee takes readers inside the goldfish bowl of the computer field for a timely analysis of what is right and wrong with computers and the people who build them.

The author blames designers and programmers for failing to understand or meet even the simplest user requirements. He says, for example, that if a user types PRINT MEMO into a computer and the machine fails to understand this simple request, "The burden is clearly on the shoulders of the programmer, not the user." Vallee maintains that this is generally caused by "The Obfuscation Imperative." He claims: "Whenever there are two ways to accomplish a given task using a computer, the first

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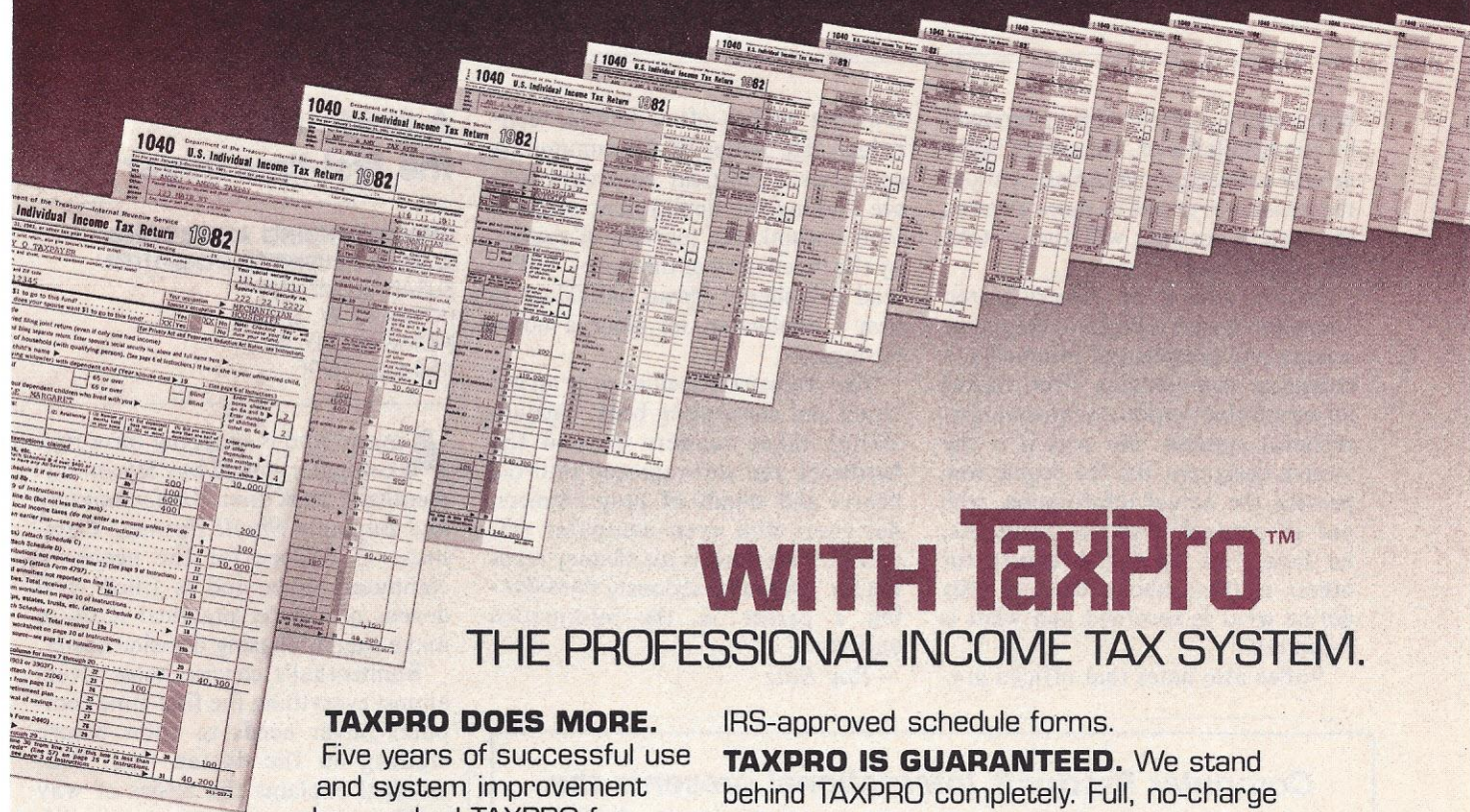
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being easily learned and understood by an unskilled user, the second being utterly confusing and useless without the assistance of one or more experts, the system designer will always take the second way."

Vallee, who is an Americanized Frenchman with a Ph.D. in computer science and president of Infomedia, a computer conferencing firm, makes an astute observation on information-retrieval systems. He says it is the system designers, not the people who provide the actual information, who are in control. System designers, he says, "set up the structure for others to think about, because they define what is recorded and what is forgotten."

Vallee also notes that official gov-

ernment policy often blocks technology. He writes of the communist countries: "Political considerations are making the deployment of these tools unthinkable (except, of course, by the machinery of the state). In Poland it is illegal for an individual to own a duplicator, let alone a home terminal."

The Network Revolution is an exciting and captivating book. Jacques Vallee takes readers beyond the hardware and software and into the hearts and minds of programmers, designers and even computer scientists. This book is mandatory reading for everyone seriously considering a career in the information business.

—Roy Katz

A guide for the first-time buyer

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SUSAN BLUMENTHAL
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INDIANAPOLIS, IN
154 pp., \$8.95

Anyone who is shopping for a first computer should buy Susan Blumenthal's book first. *Understanding and Buying a Small Business Computer* is written for the neophyte computer buyer and is filled with dozens of simple, practical ideas to make the purchasing decision easier.

Blumenthal's concise book covers almost everything the first-time computer buyer needs to know before signing on the dotted line. Blumenthal explains the basics of why and how computers work and the differences among terminals, printers, disk drives, modems and related peripherals. Her book informs the reader, but does not overwhelm him with too much information.

Blumenthal also notes that the most difficult problem often is not buying a computer, but getting employees to overcome resistance to it. The author describes in detail several important rules that should be followed to overcome employee resentment or fear. First and foremost, the author warns against laying employees off to compensate for the cost of the computer. "This will have a devastating effect on employee morale," she says. "Everyone will be wondering, 'Who's next?' If the only way you can afford a computer is to eliminate an employee, you're better off not investing in a computer at all."

The author further recommends training qualified and willing staff members to use the computer.

Blumenthal writes in plain, non-technical language, and her book includes a well-written glossary.

—Roy Katz

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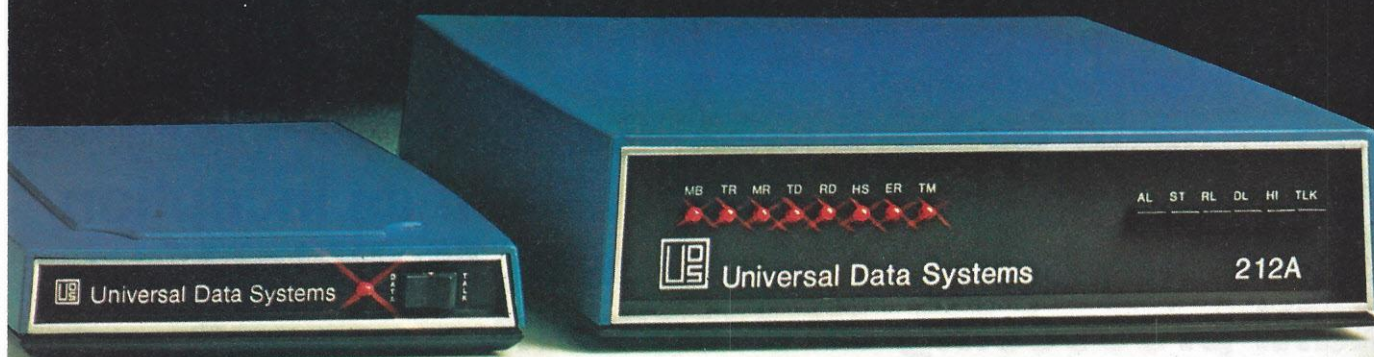
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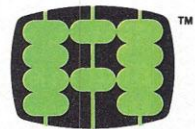
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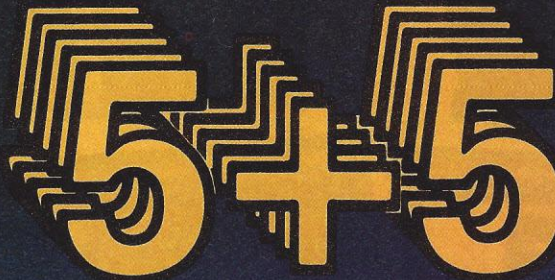
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STATE OF THE ART

NETWORKING

(continued from page 54)

working installations before. Make sure that the store can provide follow-up service once the network is installed, because it is likely that you'll spend at least a month or two debugging the system before it is truly up and running.

The future

Probably the most discussed item in networking is the baseband coaxial system Ethernet. A high-speed system designed for large network configurations, it's attractive enough to have garnered support from such diverse companies as Intel in Santa Clara, Calif., and Digital Equipment Corp. in Maynard, Mass. More important, in the world of personal computing, an Ethernet capability for the IBM Personal Computer was recently announced by 3Com Corp. of Mountain View, Calif. A plug-in controller/transceiver board, coupled with a special software, permits an IBM user to cooperatively share printers or files located at other IBM workstations; an additional network server, with 10 megabytes of Winchester memory, can be hooked up as well, to act as both a central control computer and also as memory storage for a network system. Apple, located in Cupertino, Calif., has plans to purchase local area network products from 3Com as well, suggesting additional Ethernet penetration of the personal-computer market.

However, until recently, the per-unit installation cost for Ethernet was very high—around \$2000. Now, however, Intel has announced that it has Ethernet controllers on a single chip—effectively halving the cost of the installation.

However, no single technology can lay claim to being the definitive one. For example, fiber optic cables—thousands of individual cables wrapped inside a protective shield—provide yet another possible means of data transmission for computer net-

works. Fiber optics are incredibly fast—and the fact that literally hundreds of cables can be utilized simultaneously makes for a very efficient network, indeed. The problem with fiber optics, though, is cost; the cables are expensive, and they have to be laid underground. In much the same manner as the cable-television industry, the telephone and communications companies are faced with the unenviable task of ripping up urban streets throughout the nation—and that's a very high cost indeed.

But networking as a general concept is here to stay—a recent research report from Dataquest of Cupertino, Calif., stated that some 60 percent of *all* (mainframe, mini and personal) computers installed by 1985 will be linked together in some form of network. When you consider that networks are likely only to be found in the business computing world, that means that the overwhelming majority of personal computers used for business or professional use will have some type of network connection within the next few years.

At present, however, it's tough to find consultants and dealers who have practical experience with networking installations for personal computers. Deciding which networking technology to use is a huge step beyond deciding which computer system to buy—and a matching level of technical sophistication to both sell and install the system properly is required.

A final selection criterion should be the software that makes the system go. Just what does the vendor offer? How many workstations can the system support? What's the degradation of the data-carrying capacity of the system when more workstations are added—technically speaking, does the system slow to a crawl? How easily can you and others using the network get on? How easy are the system commands to understand?

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Speed is another benefit that can make the purchase of a hard disk drive worthwhile, even if you don't require the capacity.

HARD DISK DRIVES

(continued from page 92)

often need to be turned on after the rest of the system comes on, and turned off before the rest of the system is powered down.

Then the hard disk's utility software is used to initialize the disk, since floppies need initialization before data can be stored on them. After that, the operating system(s) is installed, and you arrange your hard-disk file structure. Finally, the application programs you're going to use are placed on the drive.

Most of this is simply detail work. Just keep in mind that hard drives are not foolproof, and that straying from the path laid out in the manual could

lead to multi-megabyte-size file losses and the need to restart the software installation from scratch.

Demanding but rewarding Winchester drives are rapidly becoming the optimum mass-storage devices of 1983. What they demand is more careful detail work than technical know-how. If you can spend more than \$2 a day on substantially improving your computing productivity, and if you can put \$2000 or more up front into the project, you'll probably be glad you got a Winchester.

By the way, have you wondered where the name "Winchester" came from? It was the code name of the 1973 IBM project that spawned the first commercial disk drive that had

what are now called Winchester characteristics. Most people—even many hard-drive makers—don't know the source of the name. Rumors range from romantic (British engineers on the project named it after Winchester, England) to pragmatic (it was the name of a nearby street in San Jose). But in the recent IBM antitrust hearings, a witness who had worked on the project mentioned that it came from the fact that the first drive came in a 30+30-megabyte combination (the second was a fixed backup for the first). That reminded someone of the 30-30 Winchester rifle. And so, a fast, accurate 20th-century device was named after a fast, accurate 19th-century one. 

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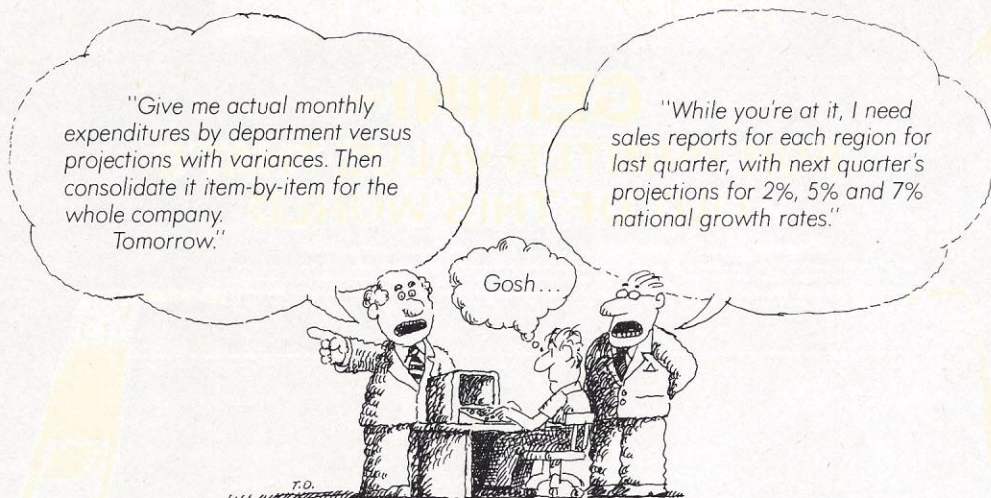
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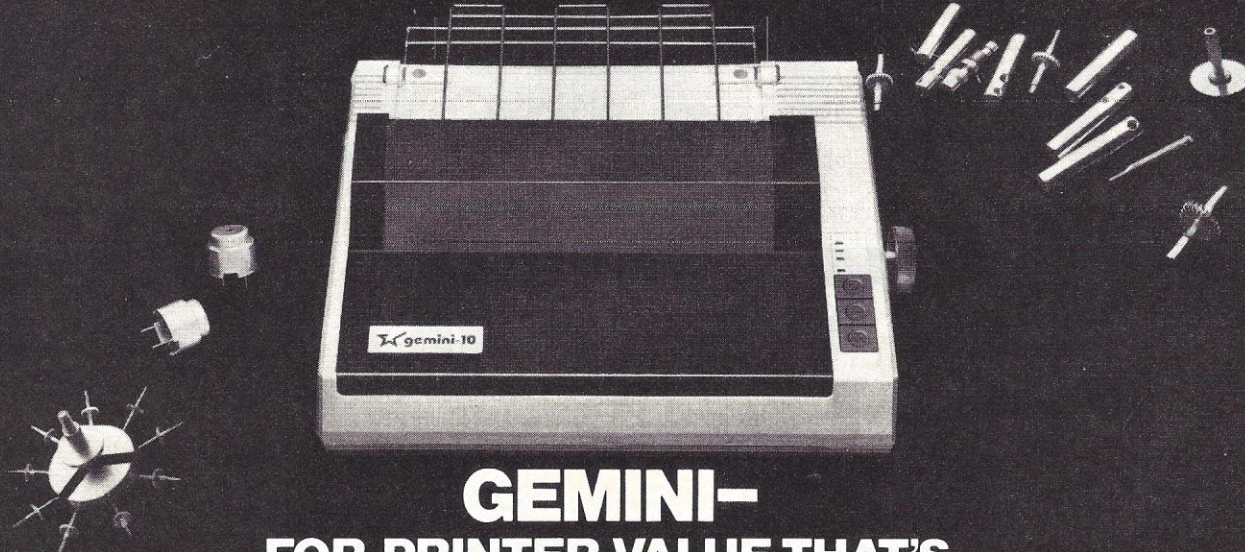
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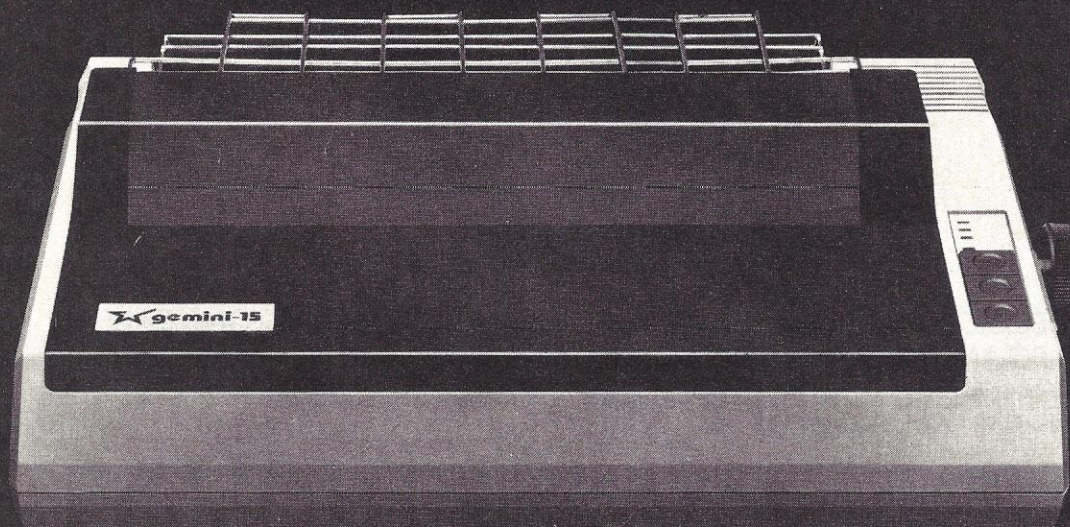
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CIRCLE 90

Technology Marches On With More Amazing Advances

Each month Personal Computing scans the hardware market to keep you up to date on everything that's new. Those products we consider to be most useful and exciting in this month's crop are described in this section and commended for your closer examination. Others are listed in the index.

HIGH-CAPACITY FLOPPY DISK DRIVES FEATURE UNIQUE DOUBLE-SIDED DESIGN

Apple Computer has taken the wraps off a new series of double-sided floppy disk drives that have six times the storage capacity of the company's current single-sided drives—870k. Single and dual disk-drive versions are called Unifile and Duofile respectively and will sell for approximately \$1000 each. Exact prices were not set at time of publication.

Unifile and Duofile offer several nice benefits. First and foremost, their high capacities offer ProFile hard-disk users an efficient means of backing up large files on diskette—only six diskettes can replicate an entire 5 mb drive. This ability to store very large files also helps users who don't have hard disk drives. With 870k capacity, users will have much more file-size flexibility.

The drives have also been designed to protect new users (or just busy ones) from inadvertently destroying the data on a diskette. Unifile and Duofile solve this problem by not having doors. The disks are clamped into the drives and ejected electronically. When the user wants to eject a disk, he pushes a button, but if the drive is in operation, it won't execute the command until it has finished writing the file.

Another major benefit of the new drives is reliability. Apple spokesmen claim the new design of the drives has the same reliability as the company's previous drives, despite Unifile/Duofile's high performance. Estimated MTBF (Mean Time Between Failure) is 8000 hours in a 25-percent duty cycle—that is, with the drive actually running a quarter of the time it's on. No special cleaning treatment or maintenance is recommended.

Representing two and a half years of research by Apple, the design is different from that of other high-density floppy drives—so much so that the company, in conjunction with 3M, had to design a new 5 1/4-inch diskette featuring a proprietary (and secret) formulation of the disk surfacing and lubricating materials. While 3M and Apple are the only sources for the diskettes, other makers are expected to produce compatible versions in the near future.

The unique diskette is necessitated by the double-sided design of Unifile and Duofile. On other double-sided drives both heads are positioned facing each other, one on the top and the other on the bottom. During read/write operations they both touch the disk in order to push the media against the head that's in action. On single-sided drives this contact is ensured by a pressure pad opposite the read/write head. Apple uses this single-sided method on its new drives by simply positioning each head at an



Apple's new double-sided floppy disk drives, Unifile and Duofile, offer 870k capacity and protect against data destruction.

opposite end of the diskette to make room for the pressure pads. This in turn requires two access slots on the diskette, which is why no other floppy diskettes will fit the Unifile and Duofile drives.

The new disk drives work with the Apple III as well as with several other computers Apple plans to introduce in the near future. They can run on all existing Apple III software, both from Apple and from outside vendors.

FOR MORE INFORMATION: APPLE COMPUTER INC., 20525 Mariani Ave., Cupertino, CA 95014; (800)538-9696.

BRINGING GRAPHICS DOWN TO EARTH

Vectrix Corp. has announced the VX series of high-resolution computer graphics processors. Priced at \$1995 without monitor, the VX128 Graphics Processor

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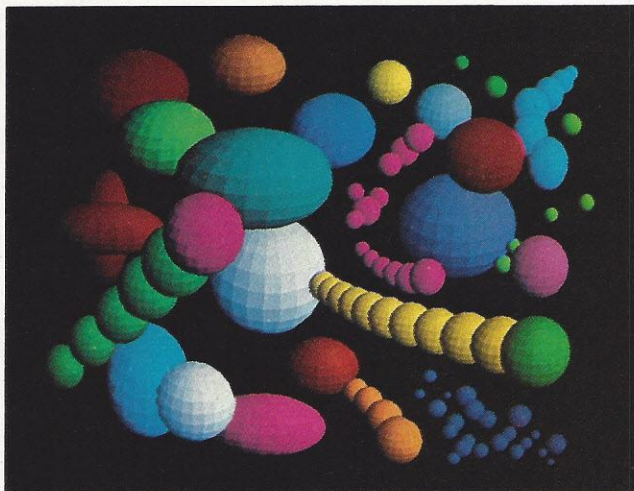
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CIRCLE 78

features 672 by 480 resolution, eight simultaneous colors and high-level graphics commands. It reportedly provides easy creation of 3-D vector images, with rotation, translation, scaling and automatic polygon fill. The company has also announced the VX384 Graphics Processor, which expands the VX128 to 512 colors.

According to Vectrix president Richard Katz, "These processors will make it possible for graphics systems designers, OEMs and hobbyists to develop high-resolution computer graphics systems based on their present computers. They can create CAD/CAM, business graphics, medical imaging systems, 3-D computer games and other sophisticated computer graphics applications at a fraction of the cost and without having to get involved in the intricacies of graphics transformations."

Novice programmers will find it easy to use the VX128's user-friendly graphic ASCII commands either in PRINT statements from BASIC and other high-level language programs or in compact hex format for assembly-language programmers, the company says. Pro-



The VX128 Graphics Processor enables the user to create high-resolution, multicolored, 3-D vector images like the one above.

How to Choose the Best Modem For Your Apple®

Features:	Hayes Micromodem II™	Novation Apple Cat II™	SSM Apple ModemCard™
110/300 baud operation	Yes	Yes	Yes
Half/Full Duplex	Yes	Yes	Yes
Auto-Dial/Auto-Answer	Yes	Yes	Yes
Fits completely inside Apple	No	No	Yes
Operates without additional serial interface	Yes	Yes	Yes
Touch-Tone® Dialing	No	Yes	Yes
"Single-Modem-Chip" Reliability	No	No	Yes
Audio Monitor	No	No	Yes
Self Testing	Yes	Yes	Yes
Warranty period	2 yr	1 yr	2 yr
Suggested Retail Price	\$379	\$389	\$299

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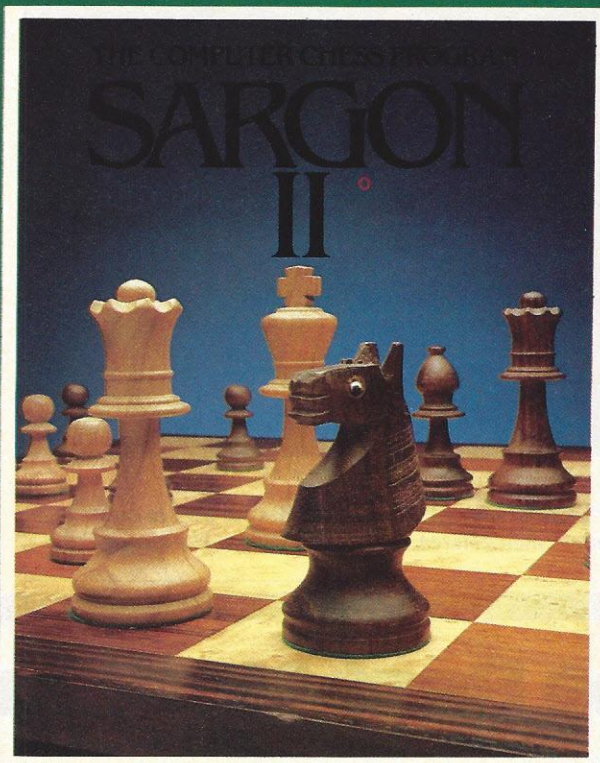
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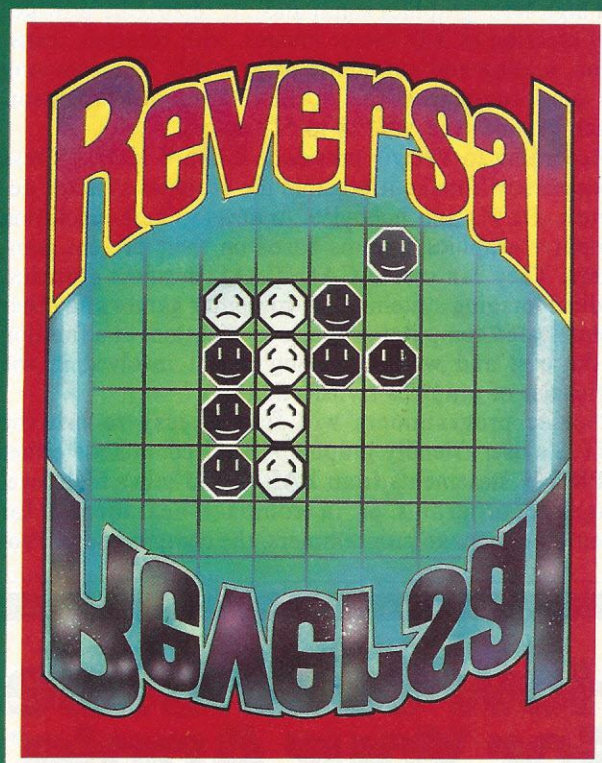
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HAYDEN SOFTWARE

HARDWARE OF THE MONTH

grams can be uploaded to the VX128 at up to 19.2k baud (serial) or faster via the parallel interface. Programmers can create polygon-based, 3-D objects with a variety of shading and line and dot patterns.

Advanced programmers can also upload 8088 assembler instructions; control low-level graphics functions directly (such as video raster timing); and access individual screen pixels for image processing, development of intelligent graphics workstations and other sophisticated computer-graphics applications.

The VX128 allows the user to load any text font, with variable zoom factor, slant and spacing, or to use a built-in character set. Characters can be mixed with graphic images.

The VX128 uses a state-of-the-art, 16-bit Intel 8088 chip to translate commands from virtually any host personal computer or minicomputer (via RS-232C serial or parallel ports); the new NEC PD7220/GDC chip for high-speed generation of lines and arcs in a variety of dot and dash patterns and 1600 nanosecond pixel update; and

a 128k RAM frame buffer with three-bit planes for individual pixel addressability in any of eight colors.

The VX384 Graphics Processor, an advanced version of the VX128, is priced at \$3995 and allows for 512 simultaneous colors from a palette of 16 million for subtle shading of solid model objects. The VX384 features a 384k frame buffer with 9-bit planes and 8-bit, digital-to-analog converters. These features allow for high-speed pixel color manipulation and bit-plane-based animation.

FOR MORE INFORMATION: VECTRIX CORP., 700 Battleground Ave., Greensboro, NC 27401; (800) 334-8181 or (919) 272-3479.

JAPANESE MANUFACTURER MAKES BID IN U.S. MARKET WITH NEW PERSONAL COMPUTER

Fujitsu, Ltd., Japan's largest computer maker, has entered the U.S. market with the Micro 16S, a personal computer designed to meet most small-business requirements. The system includes two microprocessors integrated to run under the CP/M-86 operating system, word-processing and electronic spreadsheet software, and

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HARDWARE OF THE MONTH

it can operate both 8- and 16-bit CP/M, accessing that operating system's vast library of application programs.

"The Micro 16S is a second-generation personal computer designed specifically for the U.S. market," says Richard E. Kors, vice president of Fujitsu's new Professional Microsystems Division, which will market the product in North America. "It provides the U.S. businessman with all of the features and capabilities of comparably equipped systems costing up to twice as much."

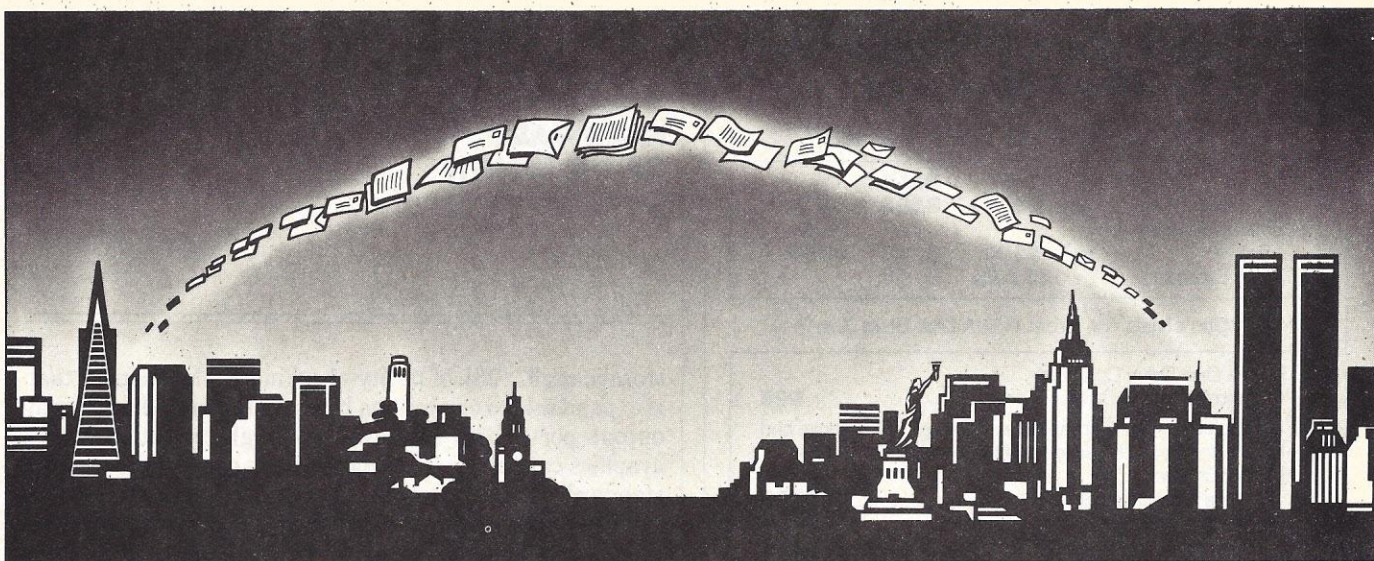
The new system was developed for use by small businesses, departments within large companies and individual professionals, such as programmers, lawyers and accountants, the company says. Because it can support the



Fujitsu's new entry in the U.S. market features a detachable keyboard and dual microprocessors.

more than 3000 application programs that work with the CP/M operating system, the Micro 16S can immediately be put to use handling all of the accounting functions of many small businesses, including word processing, order entry, invoicing, inventory control, electronic spreadsheet and many other business tasks. According to the company, departments of large firms and individual professionals can easily tailor the system to perform their own specific functions.

Hardware features of the new system include two microprocessors (Zilog's 8-bit Z80 and Intel's 16-bit 8088), two 5 $\frac{1}{4}$ -inch floppy disk drives with 320k of formatted



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8:37 AM. Your Apple receives mid-morning sales reports from the Apple in your New York office.

Transend 2 lets your Apple correspond over the phone with other Apples. Error detection features guarantee the accurate transmission of your valuable data.

1:52 PM. Your Apple displays current flight schedules and connects you to a ticket agent via **THE SOURCESM**.

SSM's Transend 1 turns your Apple into an intelligent terminal connected to your corporate computer, a timeshare system, or any

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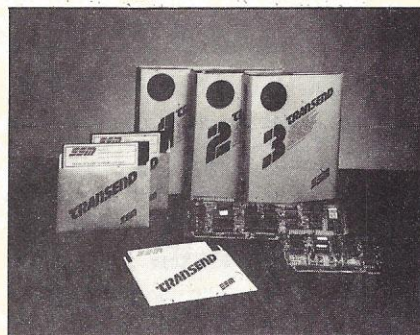
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The Transend family from SSM: Transend 1 (intelligent terminal software that lets your Apple talk to virtually any computer, including information services), Transend 2 (software that lets your Apple send verified electronic mail to other Apples), Transend 3 (full-featured electronic mail software with automatic mailing capabilities), the SSM Apple TimeCard, and the SSM Apple ModemCard.




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CIRCLE 165

188 PERSONAL COMPUTING January 1983

HARDWARE OF THE MONTH

storage each, 128k of parity-checking RAM memory that is expandable to one million bytes, both parallel and serial output ports, and an advanced, high-resolution color-graphics capability. The Micro 16S is compatible with all standard personal-computer peripheral products.

The system's detachable keyboard is designed with the user in mind, so that the keys are sculpted to match the arc of the operator's fingers. The keyboard is less than two inches thick and is slanted for ease of use and operator comfort. It is partitioned into three main functional areas: a standard typewriter layout, a separate numeric keypad and 10 programmable function keys that are located at the top of the keyboard. Other features include a "break" key, which is isolated from the main keyboard to minimize the chance of accidental use; LED indicator lights, which go on when the machine is in the insertion mode and when the "capital lock" feature is engaged; and display and cursor control keys.

A dedicated 4-bit microprocessor inside the keyboard relieves the main processors from the task of reading the keyboard, thus freeing them for more important work.

The Micro 16S' 128k of error-detection memory provides an added measure of protection for the user. When an error is detected, the system automatically shuts down. This gives the user a new level of confidence in the integrity of entered data, the company reports.

In addition to its CP/M-86 operating system, the Micro 16S comes with word-processing software and the SuperCalc (Sorcim Corp., San Jose, Calif.) electronic spreadsheet program. The application software and operating system represent a retail value of approximately \$1200.

For applications requiring large amounts of memory, an optional 10-megabyte, 5 $\frac{1}{4}$ -inch Winchester hard disk drive can be inserted into the same slot occupied by the standard floppy disk drive, giving users more than 30 times the memory capacity. The price of the hard disk drive is \$2000.

The new system can also be linked, for \$400, to the Omninet communications network, developed by Corvus Systems in San Jose, Calif. Under Omninet, the Micro 16S serves as an intelligent station in a larger network, sharing resources and programs with other machines.

The U.S. price of the Micro 16S is less than \$4000.

FOR MORE INFORMATION: FUJITSU PROFESSIONAL MICRO-SYSTEMS DIVISION, 2985 Kifer Rd., Santa Clara, CA 95051; (408)727-1700.

NEW ADDITIONS TO THE PRINTER FAMILY

Okidata Corp. has introduced two new multi-function, serial dot-matrix printers—the Microline models 92 and 93—to its Microline family of printers for business and personal use. Both new printers provide

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HARDWARE OF THE MONTH

correspondence-quality printing and versatile data-processing capabilities.

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Additional features of the Microline 92 include: enhanced and emphasized printing; 80 columns with standard characters, 136 columns with condensed characters, 96 columns with 12 pitch, 9-pin long-life print head, 96-character ASCII set, superscripts and subscripts, true descenders, underlining, proportional spacing, horizontal tabs, and six program-selectable character sizes.

The printer achieves 136 characters per line at 17 characters per inch (cpi), 96 characters at 12 cpi, 80 characters at 10 cpi, 68 characters at 8.5 cpi, 48 characters at 6 cpi, and 40 characters at 5 cpi.

Additional features of the Microline 93 include: en-

hanced and emphasized printing, 136 columns with standard characters, 233 columns with condensed characters, 163 columns with 12 pitch, 9-pin long life print head, short-line-seeking logic, 96-character ASCII set, superscripts and subscripts, true descenders, underlining, proportional spacing, horizontal tabs, six program-selectable character sizes, six and eight-line-per-inch vertical spacing, friction-feed paper handling, and Okigraph dot-addressable graphics.

This printer can print 233 characters per line at 17 cpi, 163 characters at 12 cpi, 136 characters at 10 cpi, 116 characters at 8.5 cpi, 81 characters at 6 cpi, and 68 characters at 5 cpi.

The character matrix sizes for both the Microline 92 and 93 are 9 by 9 in data-processing mode, and 9 by 17 in correspondence-quality mode (dual pass).

The Microline 92 has a suggested retail price of \$695, and the 93 costs \$1249.

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CIRCLE 146



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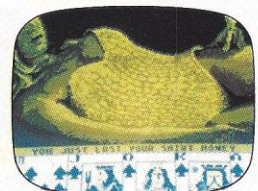
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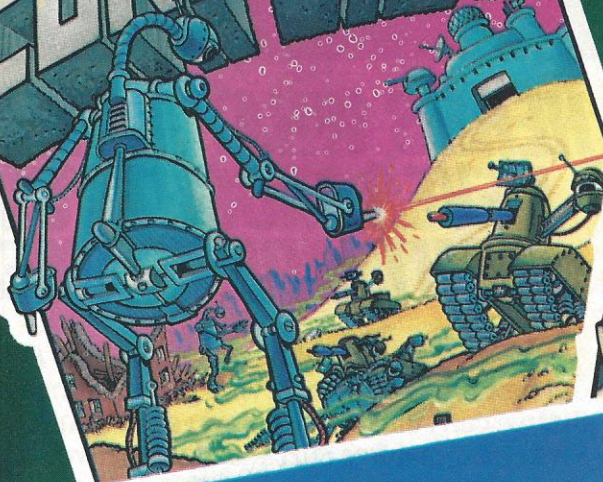
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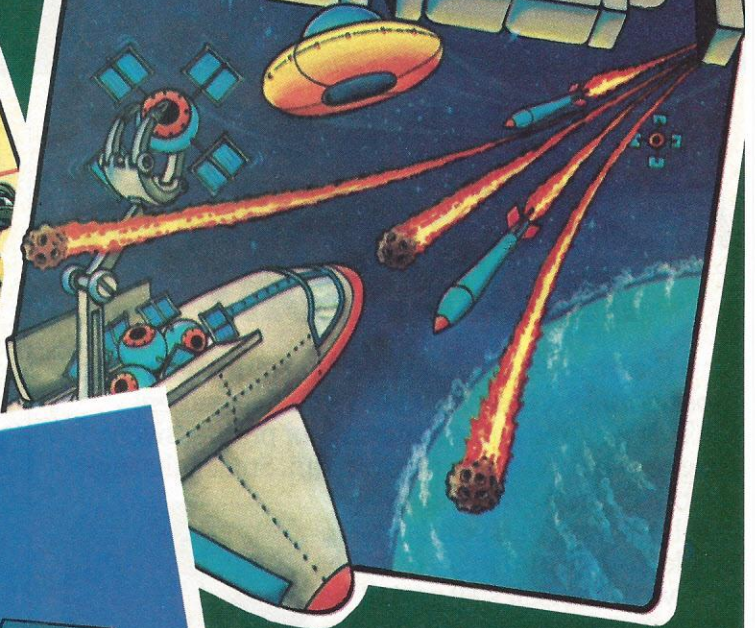
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HAYDEN SOFTWARE

HARDWARE INDEX

HARDWARE INDEX

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SYSTEMS

PRODUCT/FEATURES/PRICE	COMPANY/AVAILABILITY
Amigo a personal CP/M-based computer system designed for business and home applications; uses a Z80A microprocessor to control 44k of RAM handling the high-quality bit-mapped graphics and character display \$2395	Ontel Corp. Westbury, NY 11797 retail CIRCLE 520
Factor a Motorola 68000-based system for the industrial market, supporting UNIX and CP/M-80 from \$16,000	Victory Computer Systems San Jose, CA 95110 retail CIRCLE 521
1560 Small Business Computer System an entry-level system that will incrementally expand from a stand-alone system to multiple interconnected processors on a local network from \$3195	Datapoint Corp. San Antonio, TX 78284 retail CIRCLE 522
Micro 16S includes two microprocessors integrated to run under the CP/M-86 operating system, word-processing and electronic-spreadsheet software, and it can operate both 8-bit and 16-bit CP/M less than \$4000	Fujitsu Professional Microsystems Division Santa Clara, CA 95051 see story on page 185 retail CIRCLE 561
Spirit an Intel 80186-based system for the office environment, supporting CP/M-86 and CP/M-80 from \$16,000	Victory Computer Systems San Jose, CA 95110 retail CIRCLE 523
Terak 8600 Color Graphics Computer System a raster scan color graphics computer that will operate as a stand-alone system or as an intelligent workstation in a distributed processing environment \$12,775	Terak Corp. Scottsdale, AZ 85260 mail order and retail CIRCLE 524
Zorba Portable Computer Z80A-based system with 65k of RAM, a 7-inch CRT with an 80 by 25 display, 2 to 400k floppy	Telcon Industries Fort Lauderdale, FL 33309 mail order CIRCLE 525

(continued on page 196)

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(continued from page 193)

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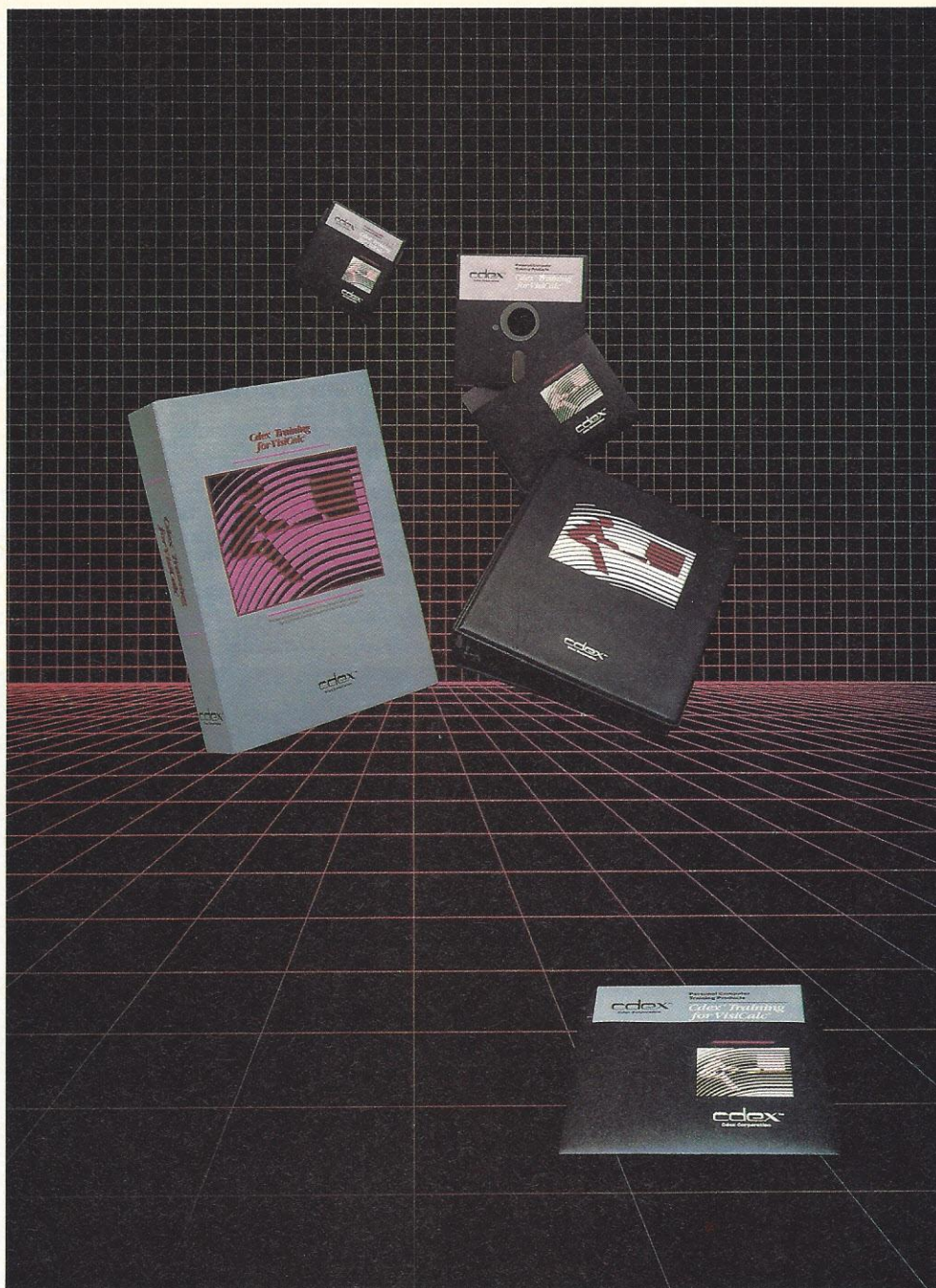
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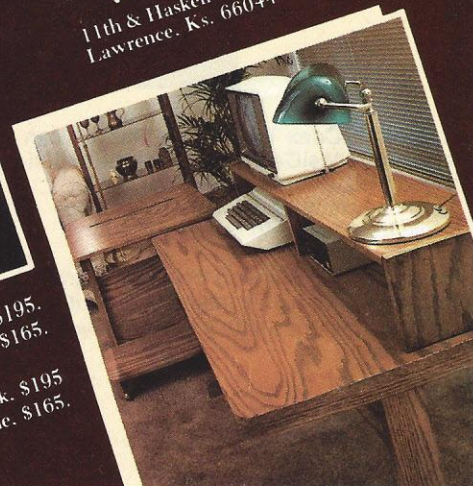
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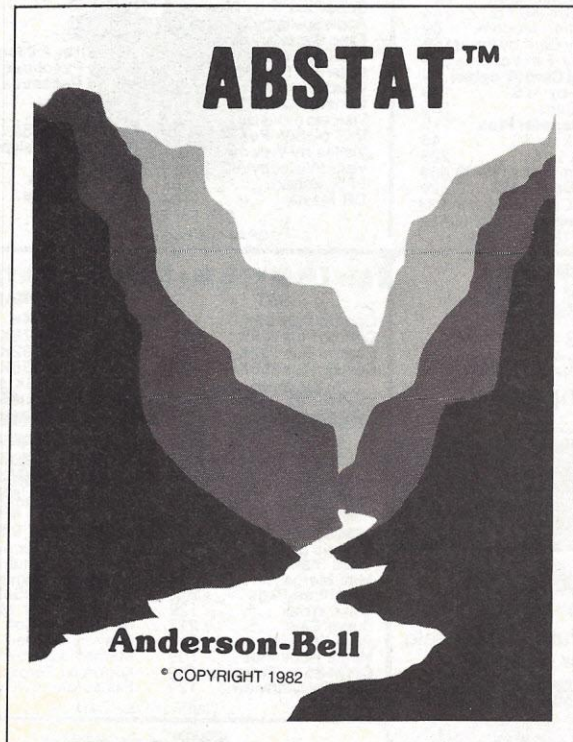
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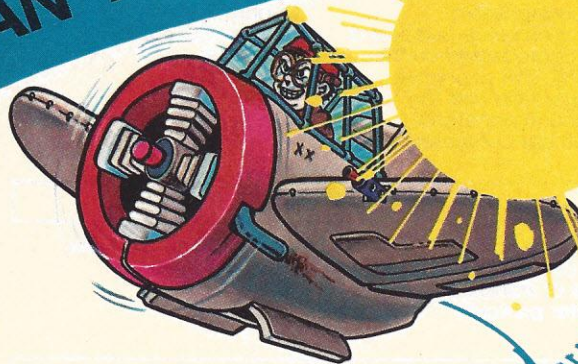
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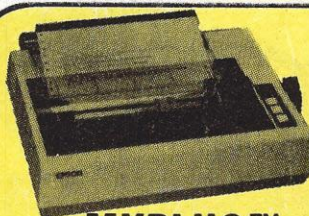
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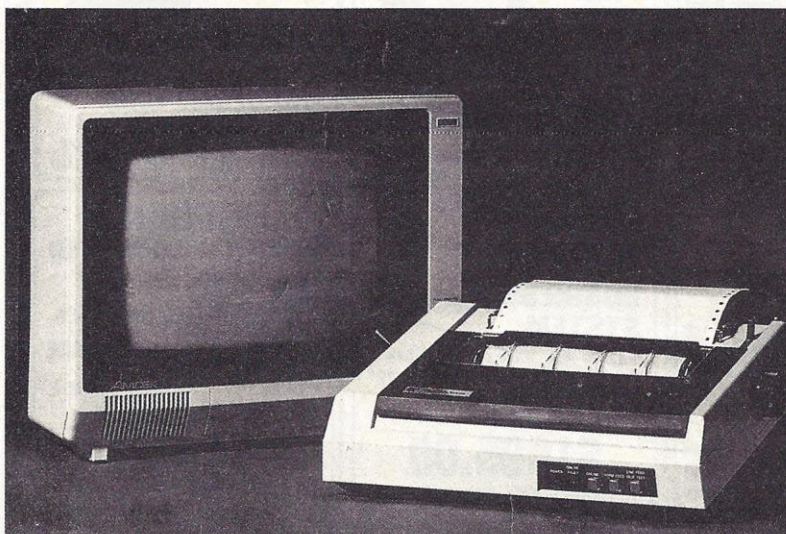


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204 PERSONAL COMPUTING *January 1983*

State-Of-The-Art Applications For Business And Learning

Each month Personal Computing scans the software market to keep you up to date on everything that's new. Those products we consider to be most useful and exciting in this month's crop are described in this section and commended for your closer examination. Others are listed in the index.

PUT REAMS OF INFORMATION AT YOUR FINGERTIPS

In order to make better business decisions, managers must have access to large amounts of information. Getting this information is not a problem, but paying for it can be. Information providers, like the large business data bases, have charged a pretty penny for the data they collect and maintain. With the aid of a new software package from VisiCorp, managers in smaller firms, as well as small businessmen, can get the information they need to make better business decisions—and at a modest cost.

The package, VisiLink, connects Apple II Plus users to the data base maintained by Data Resources, Inc. (DRI), of Lexington, Mass. DRI officials estimate that before the advent of VisiLink, their average client spent about \$75,000 per year for the information that DRI provides. Now, for the \$250 cost for VisiLink plus modest billings for the actual information the customer buys, the entire DRI data bank is available for personal use. The officials estimate that a personal user of the data bank will spend between \$360 and \$720 per year for the information he receives—a significant savings.

VisiLink is an integrated communications and data system. It allows the user to specify the exact information he needs, build the information into a template called a DataKit and download that information to his personal computer in a VisiCalc worksheet format.

VisiCorp president Dan Fylstra says this product is another step in the evolution of the use of personal computers. "Personal computers," he says, "are being interconnected more and more to provide access to other resources. They can provide access to data in machine-readable form. VisiLink provides the way that people can gain access to public business and economic information."

Fylstra compares this product to the personal computer itself. "In the past," he says, "people had only two options if they needed this kind of information. They could get the reports by subscribing to a data service like DRI, or they

could try time sharing. That wasn't a very effective way to get it because of the costs of time sharing, particularly in the connect-time charges. VisiLink does away with that, because the user spends most of his time off line; he's only connected to DRI while he's actually getting the information."

The only other way a user could get the information he needs for analysis, Fylstra notes, is to purchase some report from an information provider such as DRI and extract the information that's pertinent to his operations. That takes time, of course, and these days, time isn't often available.

Fylstra says VisiLink does away with both of these problems. It keeps costs down by having the user work off line, filling out a form on the screen that's equivalent to an order blank in a mail-order catalog. Once he's completed the form, the user tells VisiLink to go ahead and get the information he's specified. The information can be general, such as national unemployment history and projections; or it can be specific, such as costs experienced and expected in vertical industries—steel, automobiles, health care and the like.

Moreover, the user saves time when he needs to work with the information because he gets it in VisiCalc file formats. He can save the files, load them into his spreadsheet program and then manipulate that data in the same way he would manipulate data he enters himself. Some of the DataKits even contain spaces for the user to enter his own experiential data; the model then calculates expected results for the user—from his data—based on DRI models that have been incorporated in the DataKit. The user can change the DRI model if he knows that his company's experiences will be different from the DRI projections, which are based on more general history and trends.

Communications with the DRI computers are automatic with VisiLink; the user only sees that his computer is dialing and is connected. Telephone numbers are stored on the VisiLink disk; the program uses auto-dial modems—the D.C. Hayes MicroModem II, the Novation Apple-Cat II or the Novation 212 Apple-Cat II—to call the numbers (if one is busy the program goes on to the next one) that connect the personal computer to the DRI mainframes.

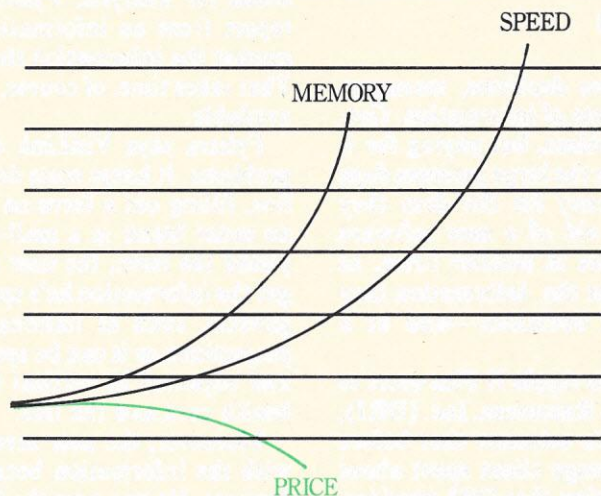
Billing is automatic, too. When the user orders a DataKit, he knows what it will cost, because prices are listed on the order blank VisiLink displays on the screen. After

(continued on page 208)

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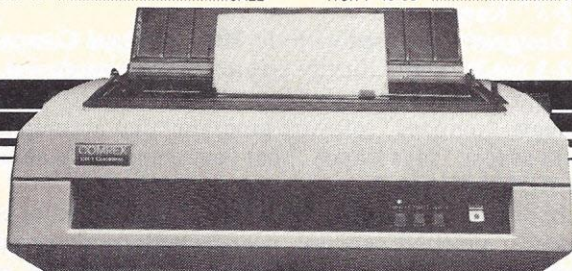
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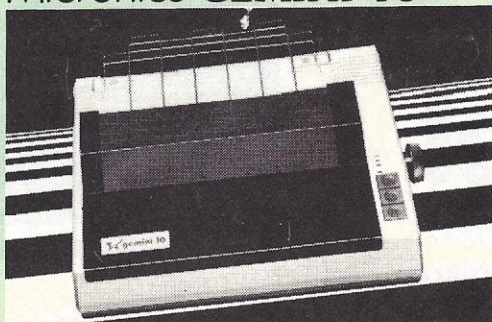


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SOFTWARE OF THE MONTH

(continued from page 205)

the personal computer verifies that the requested information has been received, DRI's computer calculates the charges and bills them to the user's account. Registration of the account is accomplished during the user's first session with the DRI data base.

DRI notes that VisiLink—really a combination of the program running on an Apple II with 48k, two disk drives and a software front end in the large computers—will compete somewhat with the services the firm already provides. But Eric Williams, DRI vice president, points out that his data base contains about 100-million items of information the user could look at. Users who only need small chunks of that information will want to use VisiLink, while those with greater information needs are likely to continue subscribing to more traditional data services.

"We look at VisiLink," Williams says, "as another distribution channel for our data. This exclusive arrangement between VisiCorp and ourselves is a good way to make our data accessible to the large, installed base (400,000 VisiCalcs have been sold) of VisiCalc users."

FOR MORE INFORMATION: VISICORP, 2895 Zanker Rd., San Jose, CA 95134; (408) 946-9000.

COMBINING SPREADSHEET, GRAPHING AND INFORMATION MANAGEMENT IN ONE PROGRAM

A new concept in computer software described by at least one industry expert as "the most significant advance in computer productivity since the development of the electronic spreadsheet" has been introduced. Called 1-2-3, it was created by the Lotus Development Corp., a new company headed by Mitchell Kapor, creator of VisiPlot and VisiTrend.

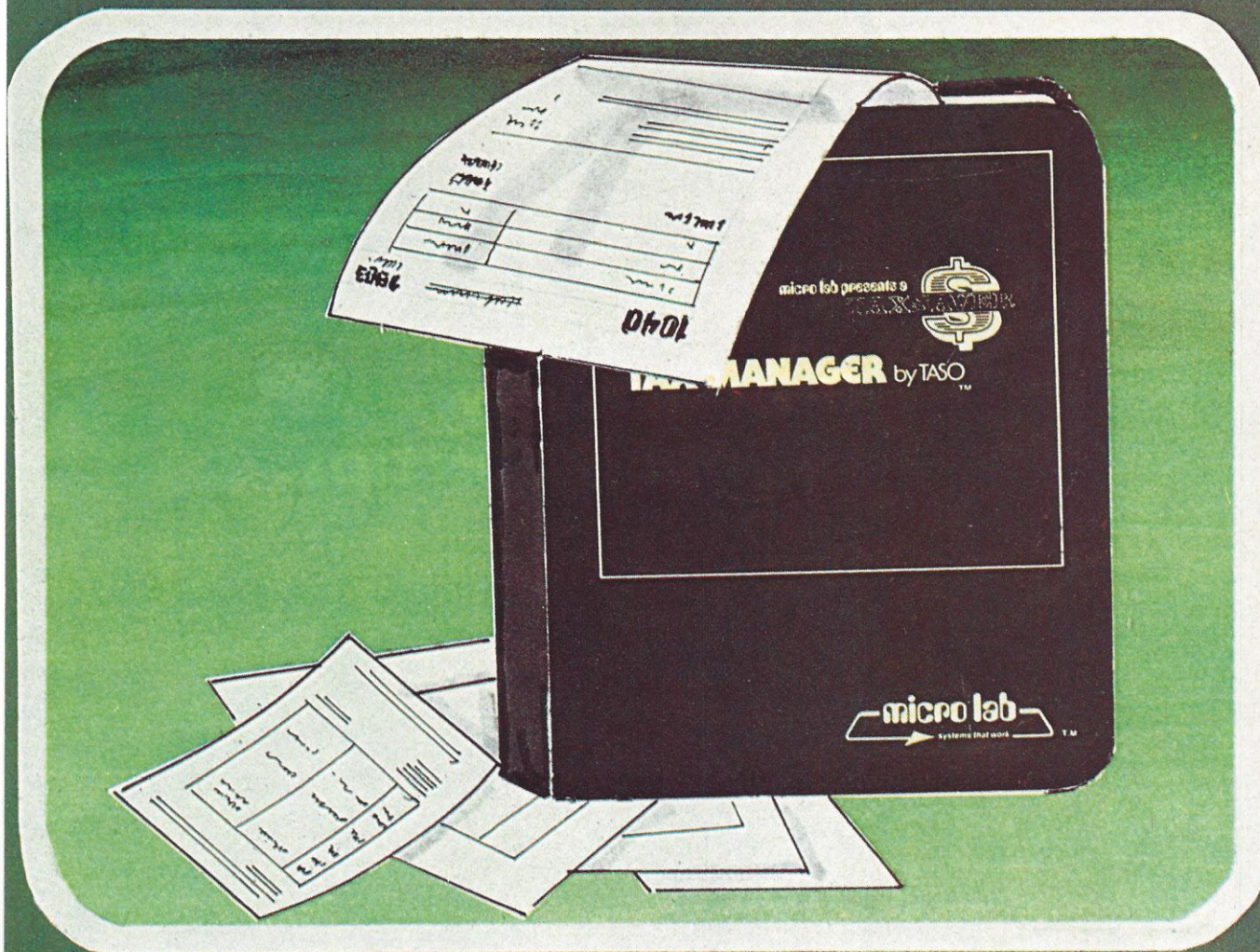
There has been a long-felt need for personal-computer software that combines, in one program, all of the attributes of spreadsheet, graphing and information management. According to Kapor, "With 1-2-3 all of this is now a totally practical reality.

"We called it 1-2-3 for a number of reasons, not the least of which is that it combines the three basic functions in a way that is as fast and easy to use—literally—as 1-2-3," Kapor says.

Designed to be used with the IBM Personal Computer, 1-2-3 has been specifically created to take maximum advantage of the machine's faster, larger "engine" through a single, "unitized" software program "that accomplishes tasks so fast," says Kapor, "that your computer is actually thinking with you."

In describing the product, Kapor cited four major components: unitized synergy; near-instantaneous speed of performance; absolute ease of use by even the most unsophisticated users; and increased power and range.

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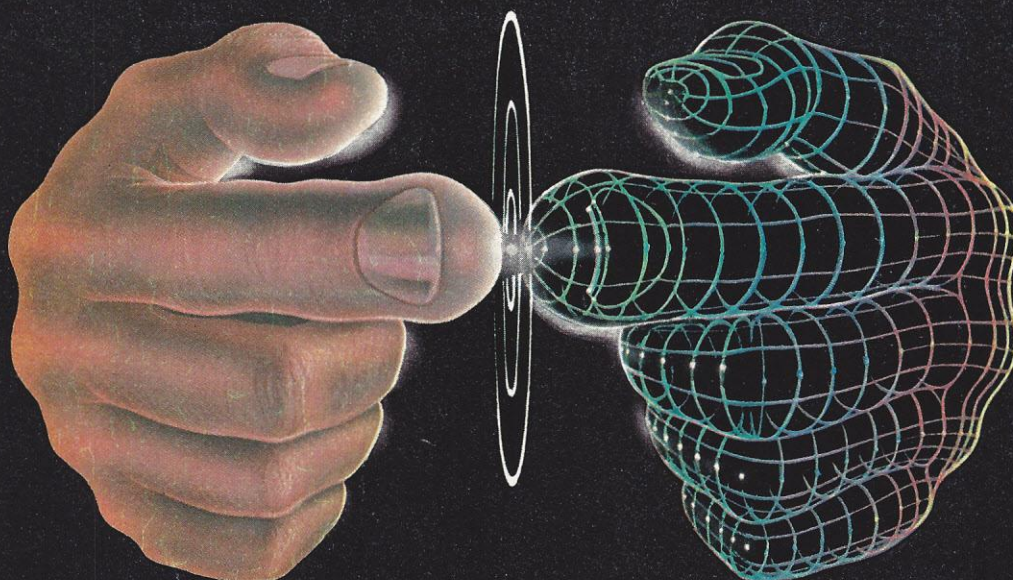
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Hardware features 24K of ROM, 32K of low-overhead RAM, a Z80A equivalent chip, high resolution graphics in 8 colors, a 248 symbol character set including complete ASCII upper and lower case, graphics symbols, design elements, mixed text and graphics on the same screen, an 80-column character display, a set of user-definable keys, full 82-key keyboard with numeric pad, and a Centronics®

compatible parallel interface, which is also perfectly compatible with the NEC PC-8023 high density dot matrix printer.

People are calling it the "end of the compromise" in microcomputers.

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"1-2-3 is truly a generic product and it can be used by almost anyone for almost any purpose," Kapor says. "When we look at its key functions in technical terms, we see 1-2-3 as 'uni-synergic' in that it performs all of the formerly stand-alone functions of spreadsheet, information management and graphing in one program—which, when combined with speed, power and ease, provides a result that, as a whole, is far greater than the sum of its parts."

Further examination of 1-2-3 reveals that each of its individual functions either improves or optimizes those functions, Kapor says. For example, 1-2-3 has a spreadsheet of 2048 rows by 256 columns, with a half-megabyte model capacity; advanced-cell and page-formatting options; many statistical, financial and calendar functions; consolidation capability; macro programming; named cells and ranges; and natural order of recalculation.

The new software also improves graphics functions and makes graphing a thinking tool as well as a visual presentation tool, Kapor continues. Single keystrokes can provide entirely new graphs, allowing users to perform "what-if" graphing.

1-2-3 produces the full, standard repertoire of chart types on the screen, in color or black and white, with extensive formatting options. Hard-copy output may be produced using the full power and resolution of a wide variety of devices, including both dot-matrix printers and pen plotters.

1-2-3's text-processing features produce memos, notes, outlines, tables and brief reports more quickly and easily than conventional word processors, according to Kapor.

Information management with 1-2-3 offers quick, simple entry and retrieval of over 2000 records. Data-base information is automatically available for statistical analysis, reports and inclusion within spreadsheet models and graphs.

1-2-3 also interfaces with a wide variety of other products by reading and writing DIF, dBase II and text files from word processors. A utility to convert VisiCalc models is also supplied.

The introductory retail price of 1-2-3 is \$495.

FOR MORE INFORMATION: LOTUS DEVELOPMENT CORP., 55 Wheeler St., Cambridge, MA 02138; (617) 492-7171.

CONTROL DATA ADAPTS PLATO COURSES FOR PERSONAL COMPUTERS

Control Data has announced that the company is now producing courses for Apple II Plus, TI99/4A and Atari 800 personal computers from its renowned PLATO computer-based education library. PLATO is a highly interactive system of self-paced, one-on-one instruction modules designed to accelerate learning, increase comprehension and respond to each student's needs through

graphics, responsive texts and a variety of student/teacher options.

The initial offering of nine courses is the first in a continuous stream of software planned for the education market. "We are using the expertise we have developed over 20 years to produce courses that don't just educate students, but stimulate and motivate them, too," says T.W. Miller, vice president of business development.

"The time of classroom acceptance of the personal computer as a teaching tool is here," says Miller. "PLATO courseware has earned high marks in classrooms during the last two decades and proved its value before personal computers were around. The advent of personal computers means PLATO courseware has a better chance of making contributions in schools and homes throughout the country."

The first nine lessons in the series are: Basic Numbers Facts; Whole Numbers; Decimals; Fractions; Physics; Elementary Mechanics; French Vocabulary Builder; German Vocabulary Builder; Spanish Vocabulary Build-

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TI940 CRT	1,795	173	96	65
TI785 Portable KSR, 120 CPS	1,795	173	96	65
TI787 Portable KSR, 120 CPS	2,195	211	117	80
TI810 RO Printer	1,695	162	90	61
TI820 KSR Printer	2,195	211	117	80
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925 CRT Terminal	850	82	46	31
950 CRT Terminal	1,075	103	57	39
Letter Quality, 7715 RO	2,695	259	144	98
Letter Quality, 7725 KSR	3,195	307	171	115
2030 KSR Printer 30 CPS	1,195	115	67	43
2120 KSR Printer 120 CPS	2,195	211	117	80
MX-80 F/T Printer	745	71	42	27
MX-100 Printer	895	86	48	32
E0400 4 Channel Stat Mux	1,525	147	82	55
E0800 8 Channel Stat Mux	2,050	197	110	74

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CIRCLE 128

SOFTWARE OF THE MONTH

er; and Computer Literacy: Introduction. Some lessons cover elementary skills, while others address junior- or senior-high skills. Like all previous PLATO courses, these are designed to meet specific teaching objectives and are individualized, modularized and reinforced with innovative supporting materials. These documents include strategies for integrating personal computers into the classroom.

The new offerings will initially be sold directly by the company at \$45 for a single lesson and \$35 for additional lessons. Other academic lessons will be introduced in 1983, the company says.

Plato computer-based education has been tested and used by more than 25,000 children and adults in a variety of applications, ranging from pilot training to teaching the ancient Ojibwa languages to Chippewas in Wisconsin. Today PLATO computer-based education can be found in more than 100 schools, colleges and universities.

FOR MORE INFORMATION: CONTROL DATA CORP., Box O, Minneapolis, MN 55440; (612) 853-6314.

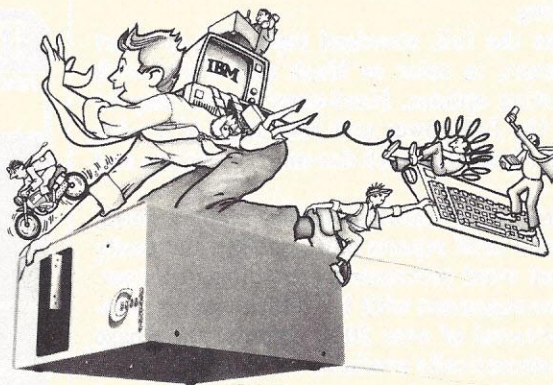
SOFTWARE INDEX

A COMPREHENSIVE LISTING OF NEW PRODUCTS

BUSINESS

PRODUCT/FEATURES/PRICE	COMPANY/AVAILABILITY
AR-1 complete invoicing and monthly statement generating system to keep track of current and aged accounts receivables for IBM Personal Computer \$248	Micro Architect Arlington, MA 02174 mail order CIRCLE 400
BACS allows for multiple users; handles all accounting functions for businesses with sales between \$1 million and \$100 million for CP/M- and MP/M-based systems \$1000 to \$1200 per module	American Business Systems Westford, MA 01886 retail CIRCLE 401
Business Analyst Series	Executec Corp.

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13.5 or 27 million bytes of disk capacity in a single cabinet with an integrated mini-cartridge tape for secure data backup.

Setting an exciting new microcomputer standard, the CYBERDRIVE combines a full package of features.

It offers new, higher performance levels, with an integrated business-oriented backup device.

As the CYBERDRIVE is made available for other systems, media transfer is assured regardless of the host hardware or Operating System.

The CYBERDRIVE slashes the seek time dramatically—e.g. the usual 5 Megabyte stepper-motor Winchester disk offers average seek time typically in the range of 100 to 200 milliseconds (incl. head settling).

With the CYBERDRIVE, the average seek time across more than five times as much data is only 33 milliseconds (incl. head settling).

This basic speed, coupled with disk cache buffering and a peak transfer rate of 1 million bytes per second, make the CYBERDRIVE a performance champ!

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- 2 - Ryan-McFarland Corp.
- 3 - Micro Business Software, Inc.
- 4 - Mini-Computer Business Applications, Inc.
- 5 - Digital Research, Inc.
- 6 - Phase One Systems, Inc.
- 7 - Bell Laboratories

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Prices and specifications subject to change without notice.

The integrated mini-cartridge tapes used for backup of data allow dumping of (for example) 10 million bytes of data in about 10 minutes... much faster than other tape or floppy disk backup techniques. Hardware read-after-write error checking is incorporated in the tape device.

... And don't fail to ask about our superb lineup of serious business software (also offered in CYBERDRIVE format) including:

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MBSI³ RM/COBOL general business applications (derived from MCBA⁴ minicomputer packages)... thousands in use... money back guarantee... source program license.

CRT¹ from Cybernetics (COBOL Reprogramming Tool!)—Program Generator for RM/COBOL to ease program development and maintenance... an alternative to a Data Base system.

CBASIC²⁵ & CBASIC⁸⁶⁵ compilers... for aficionados of a useful BASIC.

The software is available on a variety of industry-standard Operating Systems including CP/M⁵ - MP/M⁵ (both -80 & -86), OASIS⁶, PCDOS, and UNIX⁷. Inquire for specific details and prices.



8041 NEWMAN AVE., SUITE 208
HUNTINGTON BEACH, CA 92647
714/848-1922

Deciding Which Computer to Buy

Of the 1.9 million people who bought small computers last year, over 20,000 of them bought the wrong computer for their needs. And no wonder. New products are introduced into the market at a breathtaking pace. The language question. The terminology problem -RAMs, ROMs, bits, bytes, bauds, protocols and processors. What's important? What's standard and what's optional? Even the dealers are confused.

To help you tackle this problem, we pulled together many of our sources -including leading experts in the field, manufacturers, marketing analysts, computer dealers and customers. In addition, we utilized computer user groups, clubs and associations throughout the United States, contacts in Japan and numerous industry and business publications. **COMPUTER GUIDE 1983** is the natural result of learning from the knowledge and mistakes of more than one million people.

The following steps will help you with your computer shopping -whether you're buying your first computer, or updating the one you have. **COMPUTER GUIDE 1983** can help you make the right decision.

1. What is the computer to be used for?

You may want to use it for entertainment, financial planning, learning how to speak a foreign language, office work, drawing and many other tasks a computer does well. The possible uses of a computer are as varied as human activities.

2. Which program will do the best job?

There are thousands of application programs on the market to consider. It is the program that gives you the power to control the actions of the computer. You must choose the right application program.

The first section of **COMPUTER GUIDE 1983** surveys each of the application programs available with computers today. Similar programs are grouped together and compared -one against another. **COMPUTER GUIDE 1983** contains over 2,000 application programs, grouped in over 100 categories -including programs for accounting, management, professional uses, word processing, graphics, research, games, learning and special applications. Programs are described using comparison charts -listing for each application program: the program name, computer(s) and system configuration(s) required, the documentation available and the price.

COMPUTER GUIDE 1983 provides you with a quick and efficient way of deciding which application program and which computer and options for that computer can do the right job for you.

3. The language?

You cannot get a computer to do anything useful unless you know how to talk to it. This is no easy task. But, **COMPUTER GUIDE 1983** can help.

The second section of **COMPUTER GUIDE 1983** guides you in selecting the right language. Different dialects of languages are grouped in their generic category. The BASIC language, for example, is a generic name and has many dialects -including Microsoft Basic, Atari Basic, Basic Plus and Basic-80.

Each of these languages have their own machine requirements. **COMPUTER GUIDE 1983** provides the name, machine and machine requirements, documentation and price of over 500 dialects, for over 50 languages. **COMPUTER GUIDE 1983** helps you solve the language problem.

4. What about the machine?

Depending on your needs, there will probably be several computers still in the running. Now the decision is based on the guts of the machines (hardware). **COMPUTER GUIDE 1983** compares machine characteristics in an easy to follow format. You don't have to be an electrical engineer to make an intelligent decision.

The solution is to work top down and not to go any further down than is needed. Your uses for the computer determines which machine characteristics are important. **COMPUTER GUIDE 1983** divides the machine into five areas -the keyboard, video display, printer, other peripherals and I/O, processor and memory and direct access storage. These five areas correspond to your basic machine needs. For example, an accountant needs a keyboard with a numeric keypad; word processing requires a printer; games utilize a video display; a mathematician wants a very fast machine; lots of memory is best when using the LISP language; and so on, as the hardware combines with the application program to develop a complete computer system.

COMPUTER GUIDE 1983 contains machine descriptions for over 250 computer systems, produced by over 150 manufacturers. Information is displayed in spreadsheets -allowing you to get the information you need. You don't have to bother with extraneous details and cumbersome text. **COMPUTER GUIDE 1983** can accommodate millions of people in making the right decision, as varied as those decisions will be.

5. Where to buy the chosen computer system.

COMPUTER GUIDE 1983 lists hundreds of vendors, by geographical location, and by the products they sell. It also provides additional consumer information. The first ship date, the ship rate, the number installed to date, prices and what that includes, purchasing terms and warranties. **COMPUTER GUIDE 1983** contains the names, addresses and phone numbers of hundreds of manufacturers, dealers and stores throughout the United States.

No one wins when you buy the wrong computer or computer product. Make the right decision. Use **COMPUTER GUIDE 1983**.

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SOFTWARE INDEX

provides the business manager with specific task-management facilities and the ability to relate one application to another for CP/M- or MS/DOS-based systems
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Commodore Business Machines
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(continued on page 218)

Extended BASIC

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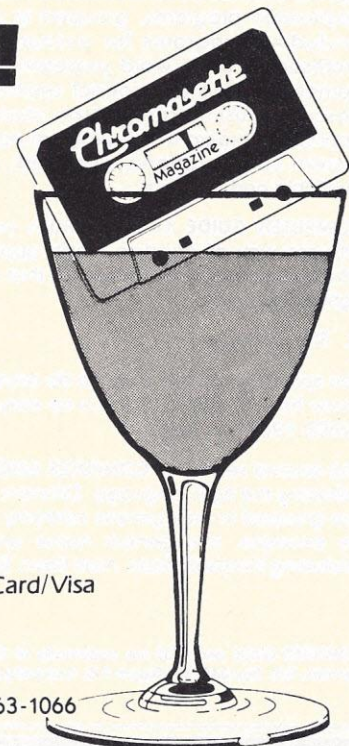
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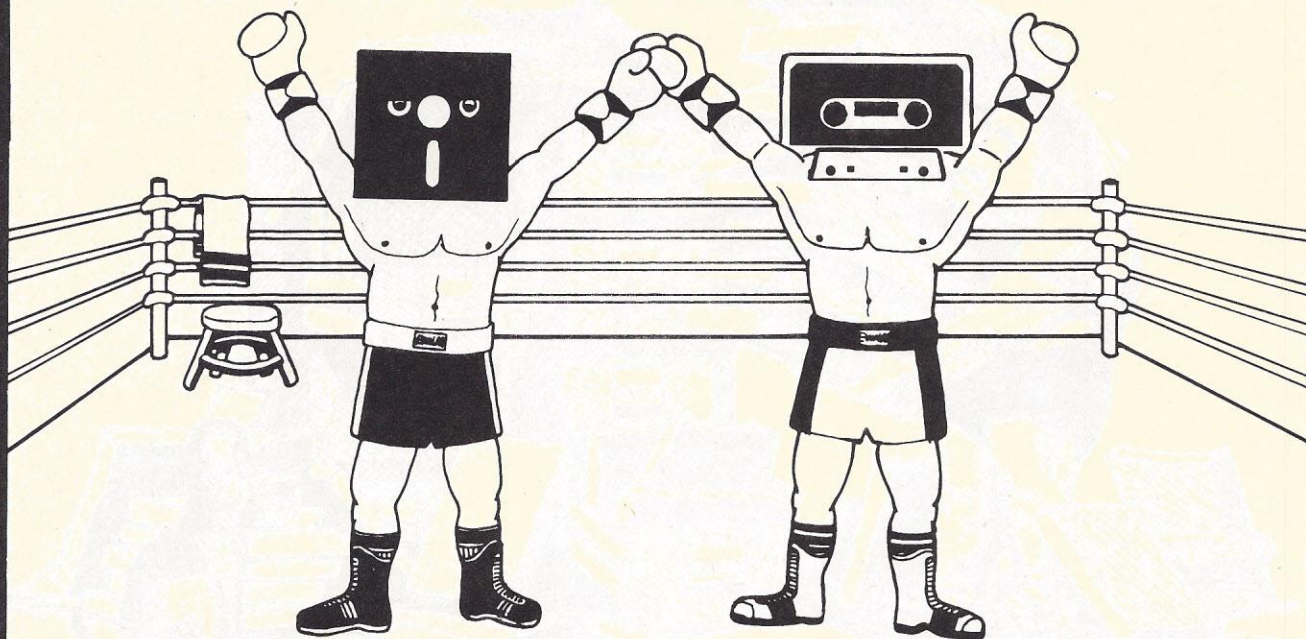
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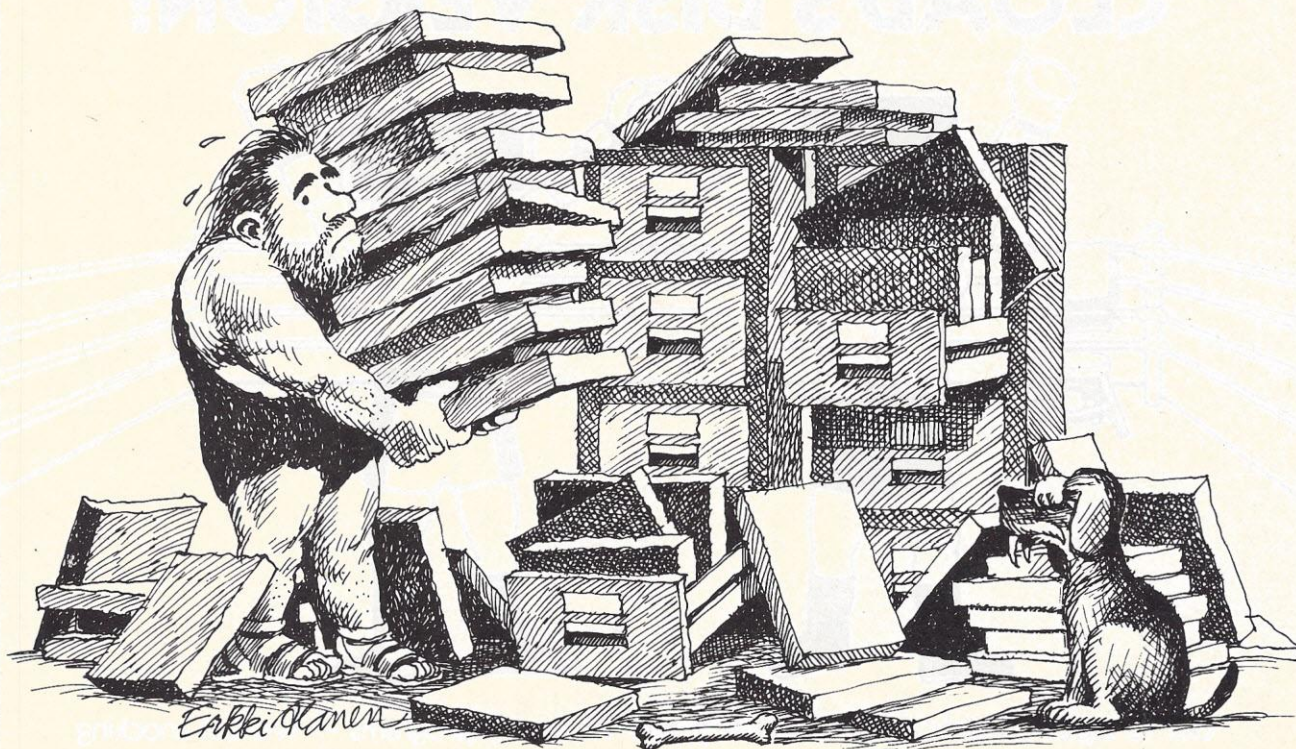


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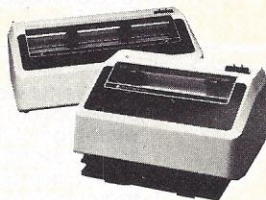


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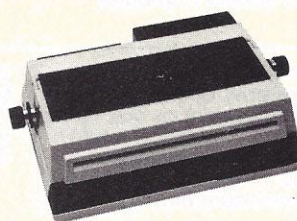


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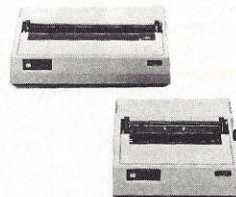
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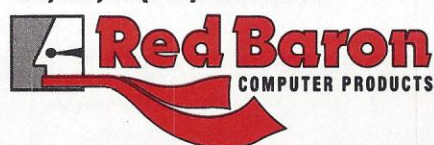
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SOFTWARE INDEX

(continued from page 214)
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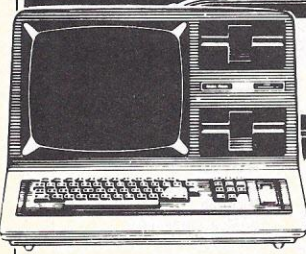
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(continued on page 228)

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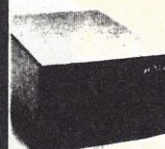
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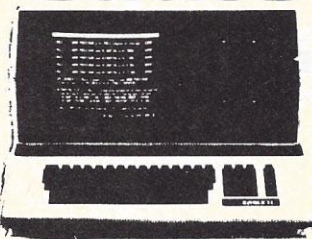
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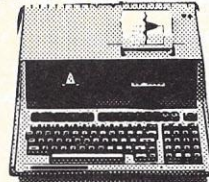


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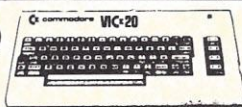
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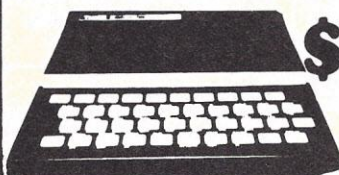
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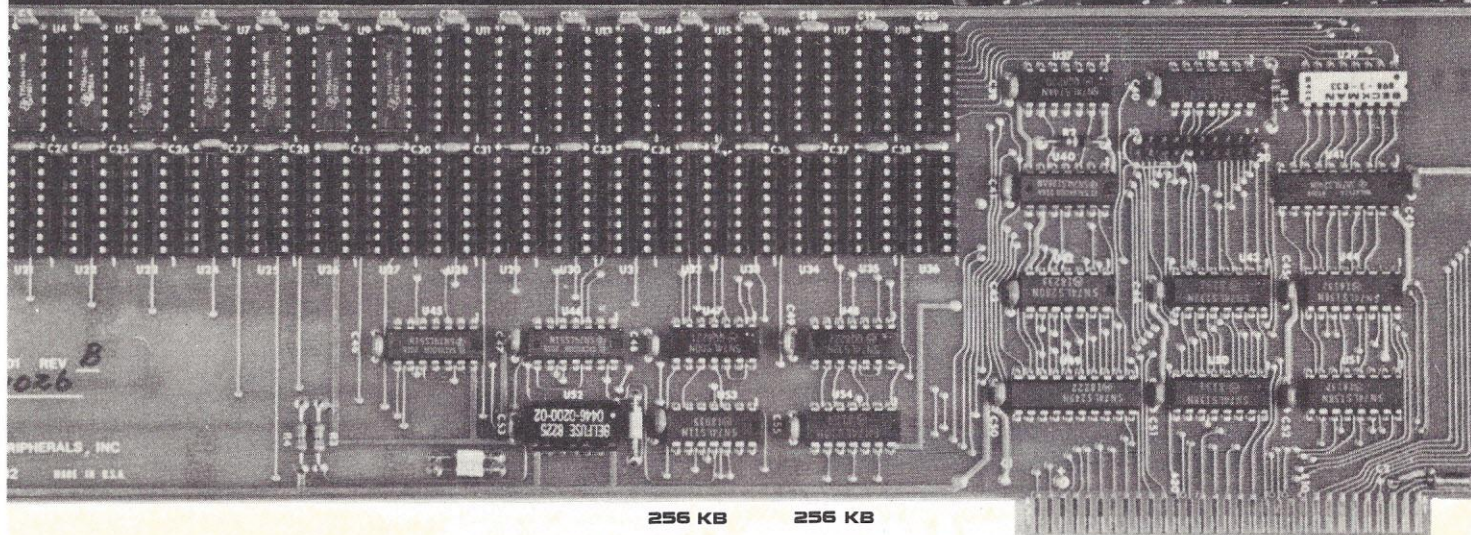
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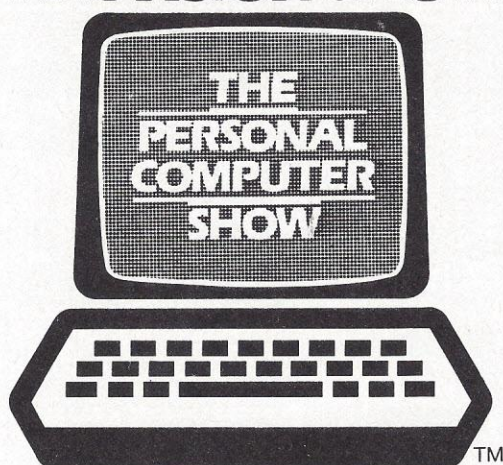
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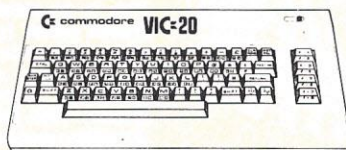
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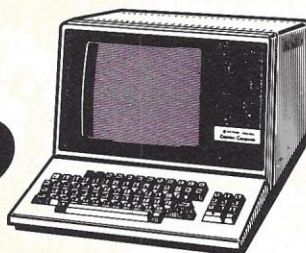
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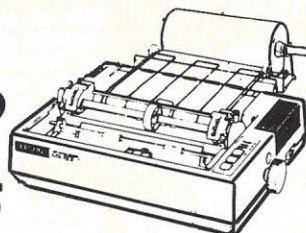
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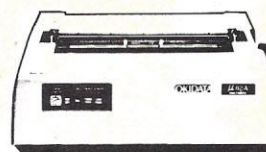


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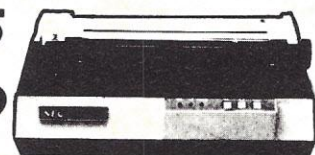


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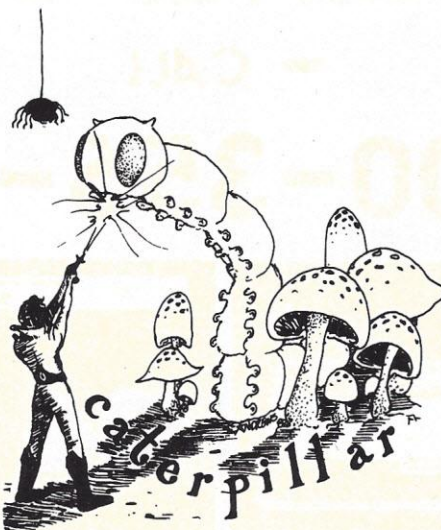
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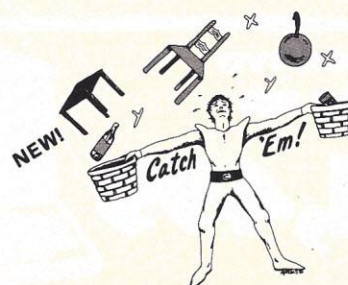
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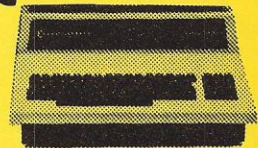
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236 PERSONAL COMPUTING January 1983

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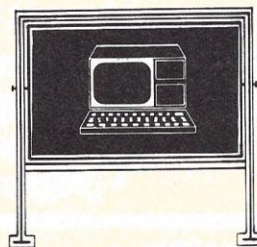
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(continued from page 236)

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(continued on page 244)



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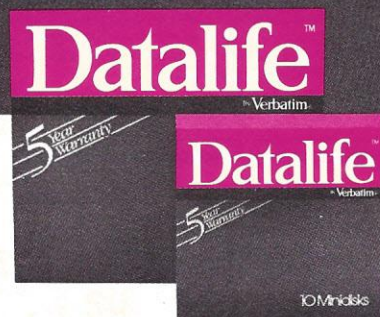
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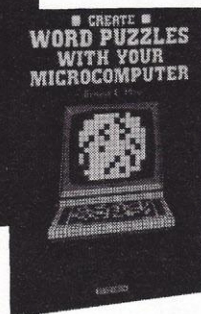


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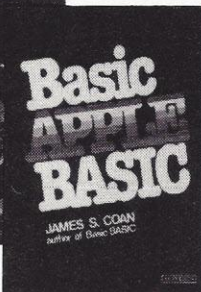
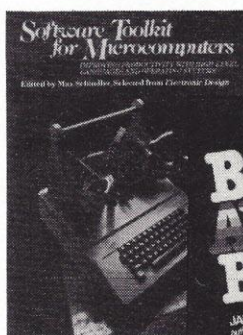


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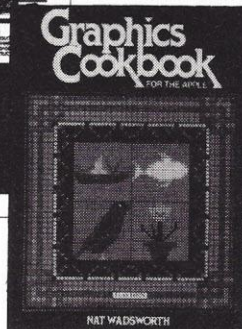
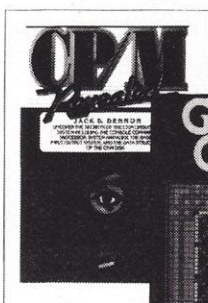


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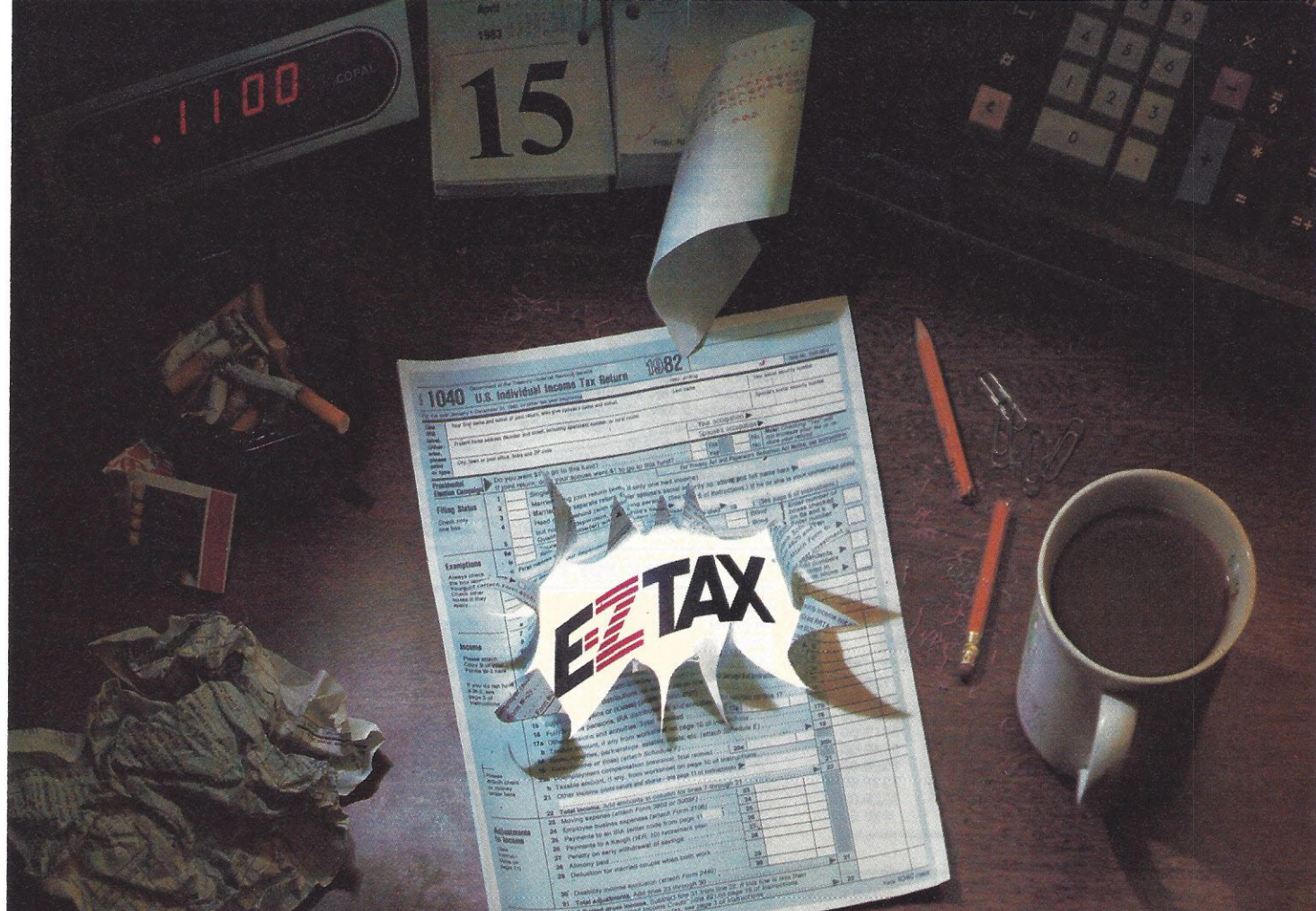
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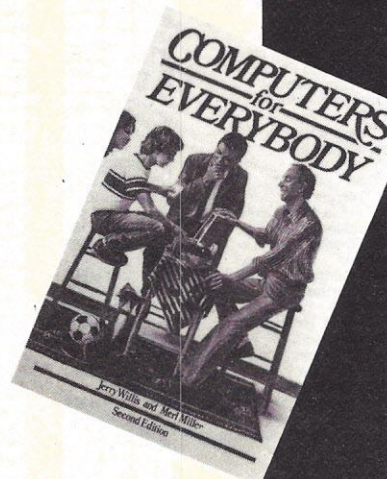
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The Xerox Store/Costa Mesa (714) 646-8941
The Xerox Store/Costa Mesa (714) 641-9099
The Xerox Store/Huntington Beach (714) 898-8066
The Xerox Store/Long Beach To Come
The Xerox Store/Concord To Come
VIP Computer Centers/Irvine (714) 551-5622
Byte Shop/Ventura (805) 647-8945
Compusup/Lancaster (805) 942-5747
Computer Plaza (805) 687-9391
Computer Shop (805) 963-1325
Computer Solutions/Santa Monica (805) 922-6639
Computer Sound/Lancaster (805) 945-5921
Computerland of Santa Barbara (805) 967-0413
Computers To-Go (805) 496-2868
Dow Radio/Oxnard (805) 486-6353
QPSB Personal Electr./Goleta (805) 967-7100
Ventura County Computer Center (805) 648-5059
Byte Shop/Sacramento (916) 961-2983
Capitol Computer/Sacramento (916) 483-4729
Computer Place/Redding (916) 221-1312
Computerland/Redding (916) 241-7922
Computerland/Sacramento (916) 920-8981
House of Computers/Sacramento (916) 971-9642
On Line Computer Center/Sacramento (916) 338-5447
Student Bookstore/Cal State U. (916) 895-6044

COLORADO

Aparat/Denver (303) 741-1778
Computer Connection/Englewood (303) 449-8282
Computer Connection/Boulder (303) 449-8282
Computer Shack/Pueblo (303) 564-3545
Computers, Inc./Englewood (303) 779-5256
Computerland/Colorado Springs (303) 574-4170
The Xerox Store/Aurora (303) 695-8660
The Xerox Store/Denver (303) 825-2386
The Xerox Store/Denver (303) 692-0414
Whole Life Distributor/Denver (303) 861-2825

CONNECTICUT

Aetna Life Club Store/Hartford (203) 273-3058
Alban, Inc./Georgetown To Come
Anchor Microsystems/Westport (203) 222-1259

Bright Ideas/Gilford (203) 453-6665
Business Machine Center/Middletown (203) 632-1939
Computer City/W. Hartford (203) 521-2245
Computer City/New Haven (203) 562-7546
Computer Ease/Milford (203) 877-7447
Computer Store (203) 563-9000
Computer Store (203) 356-1920
Computer Store (203) 627-0188
Computerland (203) 235-9204
Computerland/New Haven (203) 273-4807
Exel Sys./Stamford (203) 348-5894
Harold's Drugs/Bristol (203) 583-1854
Logical Systems Inc./Farmington (203) 677-4557
Micro Age Computer Store/Greenwich (203) 629-8171
Micro Computer Store/Norwalk (203) 847-8428
Microworld Computer, Inc./Danbury (203) 797-1623
Southern New England Electronics/E. Windsor To Come
Technology Sys./Bethel (203) 748-6856
The Xerox Store/Hartford (203) 233-9871

DELAWARE

Computerland/New Castle/Newark (302) 738-9656
Computer Store/Wilmington (302) 478-7772
Micro Products/Wilmington (302) 762-0227
The Smoke Shop/Wilmington (302) 655-2861

DISTRICT OF COLUMBIA

Computer Store (202) 272-0294
Pentagon Book Stores (202) 695-0870
Program Store (202) 337-4693
Students Book Co. (202) 223-3327

FLORIDA

Evans Business Computer Sys (209) 576-0451
Advantage With Computers/W. Palm Beach (305) 471-1753
A I Personal Computer/Longwood (305) 339-8914
Allstate Business Center Ltd./Miami (305) 665-1013
Baron Electronic Sales/Hialeah Gardens (305) 565-1300
Byte Shop of Miami (305) 264-2983
Clarks Out of Town News/Ft. Lauderdale (305) 467-1543
Computer Ctr./Palm Beaches (305) 689-3233
Computer Image/Miami (305) 271-1224
Computer Scene/Miami (305) 945-1014
Computer Scene/N. Miami Beach (305) 238-7238
Computerland (305) 862-6202
Computerland/Boca Raton (305) 368-1122
Computerland/Ft. Lauderdale (305) 566-0776
Computerland/W. Palm Beach (305) 684-3338
Electronic Equipment Co./Miami (305) 871-3500
H.I.S. Computerization/Melbourne (305) 254-9399
Lighthouse Book Store/Lighthouse Pt. (305) 781-1945
Micro Age Computer Store/W. Palm Beach (305) 683-5779
Programs Unlimited/W. Palm Beach (305) 689-1200
Sunnys At Sunset, Inc./Sunrise (305) 741-2070
The Xerox Store/Altamonte Springs (305) 831-3100
The Xerox Store/Ft. Lauderdale (305) 524-4663
The Xerox Store/Miami (305) 667-5441
The Xerox Store/N. Miami Beach (305) 947-9346
The Xerox Store/Olando (305) 898-5000
The Computer Chip/Bradenton (813) 792-2188
Computerland/Clearwater (813) 785-5579
Computerland/Seminole (813) 392-0771
Computerland/Tampa (813) 971-1680
Computerland of Lakeland (813) 644-6437
Extra Extra Newstand/Tampa (813) 886-1802
H & H Hobby Sales/Sarasota (813) 922-7711
Henry's News Stand (813) 536-3863
Micro Computer System Inc. (813) 879-4301
New World Computer/Bradenton (813) 748-5485
Poling Place/Pinellas Park (813) 541-2729
The Xerox Store/Clearwater (813) 796-7507
The Xerox Store/Tampa (813) 977-8301
The Xerox Store/Tampa (813) 876-7439
Computer Store/Gulf Breeze (904) 932-0660
Computer Sys. Resource (904) 376-4276
Computerland/Jacksonville (904) 731-2471
Computerland/Tallahassee (904) 224-9341
Florida Book Store/Gainesville (904) 376-6066
Goerings Book Ctr./Gainesville (904) 378-0363
Grice Electrs. Inc./Pensacola (904) 477-8100
Vitech/Tallahassee (904) 893-1743

GEORGIA

Atlanta Computer Mart/Atlanta (404) 455-0647
Baileys Computer Shop (404) 790-5771
Competitive Edge, Inc./Peachtree City (404) 487-6460
Computers Plus Inc./Atlanta (404) 237-7787
Computerland/Atlanta/Smyrna (404) 953-0406
Guild News Agency/Atlanta (404) 252-4166
Micro-Graphics Systems, Inc./Augusta (404) 790-5771
Peachtree Computer Center/Atlanta (404) 522-0082
The Xerox Store/Atlanta (404) 938-1276
The Xerox Store/Atlanta (404) 233-9025
The Xerox Store/Smyrna (404) 952-3901
Computer Gazebo/Savannah (912) 232-8888
Electronics 21 Inc./Savannah (912) 352-0585
Grey Communications Cons./Albany (912) 883-2121

HAWAII

Amtec Inc./Honolulu (808) 955-7429
Computer Center/Pearl City (808) 448-2171
Computerland/Hawaii/Honolulu (808) 521-8002
Radio Shack No. 7086/Aiea (808) 487-1509

IDAHO

Computer Co. Inc./Boise (208) 375-9381
Electronic Specialties/Boise (208) 375-9040

Magnum Computer/Boise	(208) 342-7304	Bethesda Computers	(301) 657-1982	Famous-Barr Computer Ctr./St. Louis	(314) 241-5469
Northwest Computer Ctr./Boise	(208) 375-6681	Chafitz/Rockville	(301) 340-3300	Gateway Electrs/St. Louis	(314) 427-6116
ILLINOIS					
Computerland/Champaign	(217) 359-0895	The Comm. Center/Laurel	(301) 782-0600	Micro-Age Computer Ctr./St. Louis	(314) 567-7644
Computerland of Springfield	(217) 522-3791	Computer Strategies Inc./Gaithersburg	(301) 840-2173	Computer Mart/Springfield	(417) 862-6500
Main Street Computer Company/Mattoon	(217) 234-4404	Computer Unlimited/Towson	(301) 321-1553	House of Computers/Joplin	(417) 782-0880
Computer-Ease/Macomb	(309) 833-3886	Computers Etc./Annapolis	(301) 268-5801	Commonwealth Computers, Inc./Kansas City	(816) 356-6502
Computer Terminal/Peoria	(309) 692-9100	Computerland/Towson	(301) 340-8484	Computer Core/Kirksville	(816) 627-1255
TZ Computers/Bloomington	(309) 829-6806	Fredericks Computer Products/Frederick	(301) 684-8884	Computerland	(816) 436-3737
Wallace Micro-Mart Inc./Peoria	(309) 685-7876	Heathkit Electrs.	(301) 881-5420	Computerland	(816) 364-4498
ABC Byte Shop/Skokie	(312) 673-3550	Komar Ltd./Baltimore	(301) 675-2200	Computerland/Independence	(816) 461-6502
Book Market/Chicago	(312) 944 3358	Logical Choice/Ellicott City	(301) 465-3175	University Bookstore/NW MO. State U/	
Book Market/Chicago	(312) 440-4475	Program Store/Baltimore	(301) 944-0200	Maryville	(816) 582-5151
The Book Store/Arlington Hgts.	(312) 255-8040	Radio Shack/Annapolis	(301) 224-2900	MONTANA	
Byte Shop/LaGrange	(312) 579-0920	The Xerox Store/Rockville	(301) 424-1450	Art's Electronics/Great Falls	(406) 453-8543
Chicago Downtown Computerland	(312) 782-7180	MASSACHUSETTS		Computerland/Billings	(406) 259-0565
Complete Computing/Lombard	(312) 620-0808	Computer Source/Pittsfield	(413) 443-7181	Computerland/Great Falls	(406) 727-8700
Compushop/Rolling Meadows	(312) 593-1800	Retail Computer Ctr./Ludlow	(413) 589-0106	Consolidated Services/Amissonia	(406) 721-1811
The Computer Store/Oaklawn	(312) 499-1300	Computer City	(617) 755-5464	Prairie Computers/Great Falls	(406) 727-6992
Computerland	(312) 949-1300	Computer City	(617) 875-8126	NEBRASKA	
Computerland	(312) 967-1714	Computer City	(617) 273-3146	Eakes Office Prod. Ctr./	
Computerland/Naperville	(312) 369-3511	Computer City	(617) 242-3350	Grand Island	(308) 382-8026
Computerland/Niles	(312) 967-1714	Computer City	(617) 826-9217	Computerland/Omaha	(402) 391-6716
Computerland/Northbrook	(312) 272-4703	Computer City	(617) 774-7118	Electronic Center/Lincoln	(402) 476-7331
Computerland/Oak Lawn	(312) 422-8080	Computer Store/Sudbury	(617) 232-5470	NEVADA	
Computerland/Oak Park	(312) 383-1606	Computer Store/Cambridge	(617) 354-4599	Computerland/Las Vegas	(702) 369-2001
Computerland/Schaumburg	(312) 253-3009	Computerland/Boston/Wellesley	(617) 235-6652	Home Computers/Las Vegas	(702) 736-6363
Computerland of St. Charles	(312) 377-7200	Computerland/Boston	(617) 482-6033	PCS Computer Service/Las Vegas	(702) 870-4138
Data Domain/Schaumburg	(312) 397-8700	Computerland of Boston/Reading	(617) 942-0707	NEW HAMPSHIRE	
Erickson Communication/Chicago	(312) 631-5181	Eden Microcomputers/Osterville	(617) 428-3515	Bitnbytes/Concord	(603) 224-8233
Illinois Microcomputer/Naperville	(312) 420-8813	The Game Shop/Acton	(617) 263-0418	Computer City	(603) 898-2390
Kroch's & Brentano's/All stores	(312) 332-7500	Harvest Computer/Cambridge	(617) 547-3289	Computer City	(603) 668-9527
Micro Computer Ctr./Geneva	(312) 232-1545	Heathkit Electrs./Wellesley	(617) 237-1510	Computerland of Manchester	(603) 668-2110
Nabih's Inc./Evanston	(312) 869-6140	Land of Electronics/Saugus	(617) 581-3133	Computerland/Nashua	(603) 889-5238
Northbrook Computers	(312) 480-9190	New England Electronics CO/Needham	(617) 449-1765	Computer Mart	(603) 883-2386
Oak Brook Computer Ctr.	(312) 941-9005	Ni-Ni's Corner, Inc./Cambridge	(617) 547-3558	Computer Town/Salem	(603) 893-8812
Page One/Roselle	(312) 529-9060	Out of Town News/Cambridge	(617) 354-7777	Strictly Software/Hudson	(603) 883-5005
Prairie News Agency/Chicago	(312) 384-5350	Palace Spa/Brighton	(617) 783-5858	NEW JERSEY	
The Software Store/Glenview	(312) 998-4753	Retail Computer Ctr	(617) 935-8060	Bytes & Pieces/Jamestown	To Come
Sorbus Station/Bensenville	(312) 459-8560	Small Business Group/Westford	(617) 992-3800	Apple Coor/Basking Ridge	(201) 766-3977
Wine Micro Computers	(312) 420-8813	Video Station/Woburn	(617) 933-1445	Computer Corner	(201) 835-7080
Univ. Bookstore/Carbondale	(618) 536-3321	YDI Electrs./Needham	(617) 449-1005	Computer Dimensions/Westfield	(201) 232-8300
Alpine Computer Ctr./Rockford	(815) 229-0200	The Xerox Store/Boston	(617) 451-5800	Computerland	(201) 845-9303
Appletree Computer/Dekalb	(815) 758-8666	The Xerox Store/Burlington	(617) 273-5665	Computerland/Eatontown	(201) 389-2333
Computer Store/Rockford	(815) 962-7580	The Xerox Store/Chestnut Hill	(617) 566-1707	Computerland/Morristown	(201) 539-4077
Computerland/Joliet	(815) 741-3303	MICHIGAN		Computer Mart of New Jersey/E.	
Ideal Computer Systems/Kankakee	(815) 935-8505	Binary Corp/Berkley	(313) 548-0533	Hanover	(201) 428-0200
INDIANA		Community News Center	(313) 662-6150	Computer Mart of New Jersey/Green	
Computer Plus	(219) 865-3930	Computer Center/W. Bloomfield	(313) 422-2570	Brook	(201) 752-6300
Computerland/Ft. Wayne	(219) 483-8107	Computer Connection/Farmington Hills	(313) 447-4470	Computer Mart of New Jersey/Iselin	(201) 283-0600
Computerland/Mirabel	(219) 769-8020	Computer Center, Inc./Grand Blanc	(313) 694-3704	Computer Nook/Pine Brook	(201) 575-9468
Computerland/Mishawaka	(219) 256-5688	Computer Horizons	(313) 464-6502	Computer Technicians/E. Brunswick	(201) 238-2780
Data Base/Ft. Wayne	(219) 484-3164	Computer Mart	(313) 649-0910	Computer Universe/Paramus	(201) 262-0960
A Computer Store/Indianapolis	(317) 898-0331	Computer Mart/Flint	(313) 234-0161	Earth Rise Micro Sys./Madison	(201) 822-0518
Computer 1/Indianapolis	(317) 257-3336	Computerland	(313) 973-7075	Entre Computer Center/Paramus	(201) 342-0080
Computercraft/Carmel	(317) 846-5996	Computerland/Southfield	(313) 356-8111	Felice's Follies/Red Bank	(201) 842-2862
Computerland/Anderson	(317) 649-1122	The Family Computer Center/Berkley	(313) 546-8114	Heathkit Electr. Ctr./Fairlawn	(201) 791-6935
Computerland/Indianapolis	(317) 849-8811	Front Page Bookstore/Pontiac	(313) 332-3431	Lloyd's Computers/Ridgewood	(201) 445-8801
Computerland/W. Lafayette	(317) 463-3546	Heathkit Electr./Detroit	(313) 772-0416	Monmouth Computer Services/Shrewsbury	(201) 747-6745
Graham Electrs./Indianapolis	(317) 634-8202	Heathkit Electr. Ctr./Detroit	(313) 535-6480	Software City/Fairview	(201) 943-9444
The Software Exchange/Indianapolis	(317) 251-7786	Micro Station Inc./Southfield	(313) 358-5820	Software City/Teaneck	(201) 692-8317
Von's Bookshop/W. Lafayette	(317) 743-1915	New Horizons Book Shop/Roseville	(313) 296-1560	Software Network/Upper Montclair	(201) 744-2952
Data Domain/Bloomington	(812) 334-3607	Rainbow Computers/Troy	(313) 528-3535	Stonehenge Computer/Summit	(201) 277-1020
Hoosier Electrs./Terre Haute	(812) 232-8508	Rochester Book Center	(313) 651-0199	The Computer Center, Inc./Montvale	(201) 391-1006
KOE Computers./Div. Knapp/Terre Haute	(812) 232-4361	Simtec/Birmingham	(313) 855-3990	Bargain Brothers/Trenton	(609) 883-2050
IOWA		Spectrum Computers/Lathrup Village	(313) 559-5252	Computer Encounter/Princeton	(609) 924-8757
Computer Country, Inc./Marion	(319) 377-9437	Community Newscenter	(517) 694-0490	Computer Mart of New Jersey/Lawrenceville	(609) 452-1858
Memory Bank/Bettendorf	(319) 386-3330	Community Newscenter	(517) 349-3510	The Computer Port/Northfield	(609) 641-4300
Memory Bank/Clinton	(319) 242-2755	Computer Mart/Lansing	(517) 351-1777	Computer Workshop/Cherry Hill	(609) 665-4404
The Partstore/Marion	(319) 373-1803	Comtec/Owosso	(517) 725-7326	Computerland/Cherry Hill	(609) 795-5900
Omni Computer Center/Des Moines	(515) 276-8858	Computer Mart/Kalamazoo	(616) 329-1000	Computerland/Lawrenceville	(609) 882-1400
KANSAS		Computerland/Grand Rapids	(616) 942-2931	Personal Computing	(609) 927-3880
Amateur Radio Equip./Wichita	(316) 264-9166	Computers & More/Grand Rapids	(616) 243-3525	Radio Shack/Moorestown	(609) 244-7494
Computerland/Hutchinson	(316) 662-6832	Heath Computer Store/St. Joseph	(616) 982-3215	Radio Shack/Toms River	(609) 234-2666
Computerland/Wichita	(316) 684-3870	Professional Computer System/St. Joseph	(616) 429-9616	Sorbus Station	(609) 662-0997
High Technology/Wichita	(316) 262-0315	Professional Data Corp./Marquette	(906) 228-2626	NEW MEXICO	
Book Shop/Manhattan	(913) 537-8025	Granada News/Duluth	(218) 727-9122	Computer Shop/Clovis	(505) 762-3327
Commonwealth Computers, Inc./Overland Park	(913) 648-8086	Readmore Book & Card/Mankato	(507) 345-5704	Computerland/Santa Fe	(505) 988-8800
Computerland	(913) 492-8882	Bit by Bit Computer Resource Ctr./St. Paul	(612) 646-4833	Electronic Parts Co./Albuquerque	(505) 293-6161
Computerland/Lawrence	(913) 841-8611	Computer Depot/Bloomington	(612) 375-2008	Micro Waves Computer Store/Albuquerque	(505) 883-0955
Computerland/Topeka	(913) 267-6530	Computer Professionals/Burnsville	(612) 435-8080	Computer Tech Assoc./Las Cruces	(915) 533-2108
Online Computer Centers/Overland Pk.	(913) 341-6651	Computerland	(612) 599-1844	NEW YORK	
Personal Computer Ctr./Overland Pk.	(913) 649-5942	Digital Den/St. Paul	(612) 689-8442	Computer Center/New York	(212) 889-8130
The Computer Room/Beatty	(913) 341-3500	Micro Age Computer Store/Minneapolis	(612) 338-1777	Computer Discount Services/New York	(212) 757-8698
KENTUCKY		Minnesota Book Center/Minneapolis	(612) 373-5734	The Computer Edge/Mt. Kisco	(212) 664-3212
Computer Emporium/Louisville	(502) 589-9482	Personal Business Systems/Minneapolis	(612) 929-4120	Computer Era/New York	(212) 860-0500
Computerland of Bowling Green	(502) 781-9990	Readmore Bookstore/Minneapolis	(612) 333-3628	Computerland	(212) 840-3223
Heathkit Electr./Louisville	(502) 245-7811	Schindler's Hennepin News/Minneapolis	(612) 333-6942	Computerland of Little Neck	(212) 423-5280
Stereo Stable's Computer Stall/Owensboro	(502) 685-6016	Shinder Book & News/St. Paul	(612) 227-0899	Computerland of Wall Street/NY	To Come
Computer Place/Lexington	(606) 276-3594	The Xerox Store/Edina	(612) 929-4334	Comtek/Brooklyn	(212) 332-5943
Computer World/Ashland	(606) 329-0545	The Xerox Store/Minneapolis	(612) 332-6866	Comtek/Staten Island	(212) 698-7050
Micro-Age Computer Store/Lexington	(606) 278-0304	The Xerox Store/St. Paul	(612) 227-3366	Datel Sys./New York	(212) 921-0110
LOUISIANA		MISSISSIPPI		Greenwich Village Computers/New York	(212) 254-9191
Computers For All/New Iberia	(318) 365-9507	The Book Store/Greenville	(601) 332-2665	Harcourt Brace Bookstore/New York	(212) 888-3333
Computer Shoppe Inc./Metairie	(504) 454-6600	Computer World/Hattiesburg	(601) 544-3135	Leigh's Computer World/New York	(212) 879-6257
Computer Terminal/New Orleans	(504) 891-0007	Computerland/Jackson	(601) 362-8755	Magazine Emporium/New York	(212) 864-0500
MAINE		Miss-Lou Computer Center/Natchez	(601) 442-2836	Majority New Dist./New York	(212) 243-7770
Coastal Computer Center/Brunswick	(207) 729-0298	Southeastern Aud. Vis./Starkville	(601) 324-0797	Papyrus Books/New York	(212) 864-8862
Retail Computer Ctr./Elsworth	(207) 669-6736	MISSOURI		Programs Unlimited of Smithaven	To Come
MARYLAND		Computer Center/St. Louis	(314) 444-3111	Super Business Machines/New York	(212) 964-6666
Balance Corp. Center Inc./Baltimore	(301) 625-1100	Computer Country-North	(314) 921-5644	Computerland/Massina	(315) 769-9971
		Computerland/St. Louis	(314) 567-3291		

PERSONAL COMPUTING DEALERS

Computers Etc./Syracuse	(315) 446-6502	PENNSYLVANIA	Computer Pro/Ft. Worth	(817) 654-3360
Radio World, Inc./Oriskany	(315) 736-0184	A B Computers/Montgomeryville	Heathkit	(817) 737-8822
Berliner Computer Ctr./New Hyde Pk.	(516) 775-4700	Computer Forum/Frazer	Waco Comm.	(817) 772-8550
Computer Headquarters	(516) 698-8636	Computerland/Dresler	Computer Tech Assoc./El Paso	(915) 533-2108
Computer Microsystems/Manhasset	(516) 627-3640	Computerland/Lancaster	Computer West	(915) 655-3391
Computer Shoppe/Patchogue	(516) 758-6558	Computerland/Lehigh Valley	UTAH	
Computerland/Little Neck	(516) 887-4747	Computerland/Paoli	Computerland/Orem	(801) 224-2608
Computerland/Nassau County	(516) 742-2262	Computerland/Philadelphia	Computerland/Salt Lake	(801) 364-4416
Data Scan Comp. Sys./Farmingville	(516) 698-6285	The Computer Source/W. Reading	Hi-Fi Shop/Datalines/Ogden	(801) 621-5244
Future Visions Computer/Melville	(516) 423-7820	Doc's Computer Supply Center/Ardmore	Quality Technology/Salt Lake City	(801) 521-5040
Harrison Radio/Farmingdale	(516) 293-7990	Drexel University Book Store	VERMONT	
Heathkit Electrs./Jericho	(516) 334-8181	Heathkit Electr. Ctr./Frazer	Data Tronic/Brattleboro	(802) 257-0555
Programs Unlimited/Jericho	(516) 997-8668	Main Line Computer Center/Wayne	Video Connection/Brattleboro	(802) 254-6026
Syosset Video & Electrs./Syosset	(516) 921-5454	Marketline Sys./Huntington Valley	VIRGINIA	
Castle Computers/Latham	(518) 783-9405	Micro Computer Center/Media	Computer Store/McLean	(617) 272-0294
Computer Room/Albany	(518) 869-3818	Mighty Byte Computer Ctr./Horsham	Arlington Electric Wholesale/Arlington	(703) 524-2412
Future Distribution/Mogers	(518) 561-5703	Tree of Knowledge/Reading	Computer Place	(703) 982-3661
Lela Computer Sultors/Albany	(518) 272-2691	Video Village Computer Center/Philadelphia	Computer Works/Harrisonburg	(703) 434-1120
Computer Tree/Endwell	(607) 748-1223	Computer House/Pittsburgh	Computers Plus/Alexandria	(703) 971-1996
Computerland/Ithaca	(607) 277-4888	Computer Workshop/Monroeville	Computerland	(703) 491-4151
Computerland/Johnson City	(607) 277-4888	Pittsburgh Computer Store/Pittsburgh	Computerland/Tysons Corner	(703) 893-0424
Unicorn Electronics/Johnson City	(607) 798-0260	Computer Store/State College	H.B. Computer Ctr./Charlottesville	(703) 295-1975
Computer Resource/Williamsville	(716) 633-9510	One Step Computer Shoppe	Heathkit Electrs.	(703) 765-5515
Computerland	(716) 586-0378	Computerland/Harrisburg	Home Computer Ctr./Newport News	(703) 595-1955
Home Computer Ctr./Rochester	(716) 244-6237	Erie Computer Co./Erie	Jack L. Hartman & Co., Inc./Roanoke	(703) 362-1891
Micro Age Computer Store/Rochester	(716) 244-9000	RHODE ISLAND	Program Store/Falls Church	(703) 536-5404
Modern Tek Shop, Inc./Snyder	(716) 839-5800	Computer City/Providence	Virginia Micro Sys./Woodbridge	(703) 491-6502
Readout Computers/Bufalo	(716) 634-9354	Computer Power/Warwick	V.P.I. Facilities/Blacksburg	(703) 961-5991
All Things Computer/Scarsdale	(914) 723-6262	Computerland/Providence	The Xerox Store/Fairfax	(703) 591-8845
Computer Corner/White Plains	(914) 949-3282	SOUTH CAROLINA	The Xerox Store/Vienna	(703) 442-9655
Computer Store/White Plains	(914) 428-1661	Colson Comm/Rockhill	Computerland	(804) 973-5701
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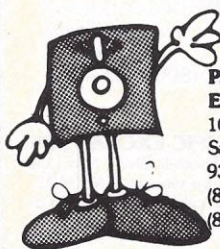
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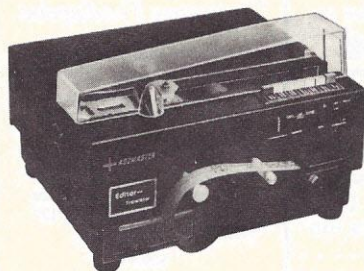
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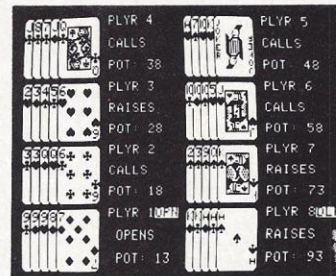
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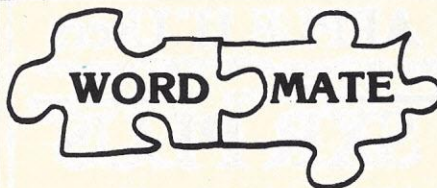
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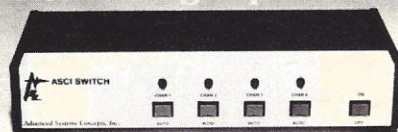
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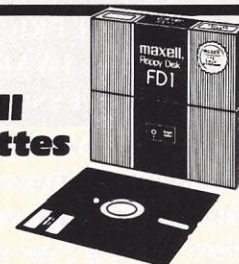
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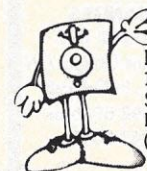
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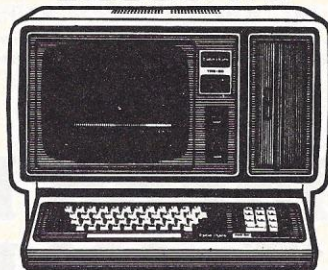
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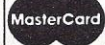
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2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEYN	Break-even analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEP	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQJQOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEQQPB	As above but with quantity price breaks
55	QJUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project

59	WACC	Weighted average cost of capital
60	COMBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUID	DOVE business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFDD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
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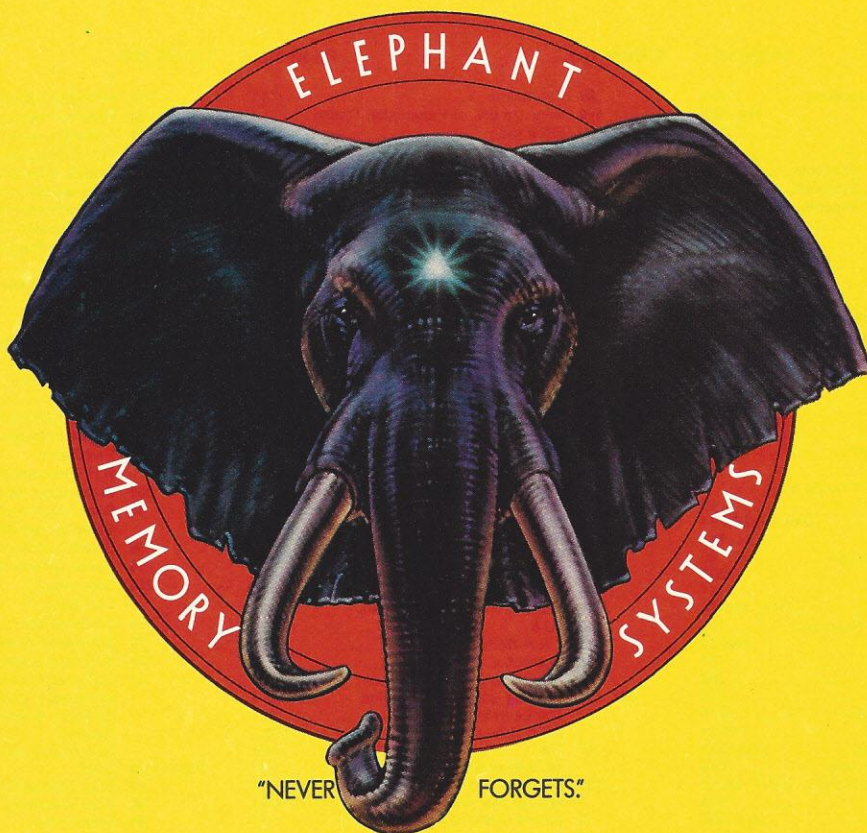
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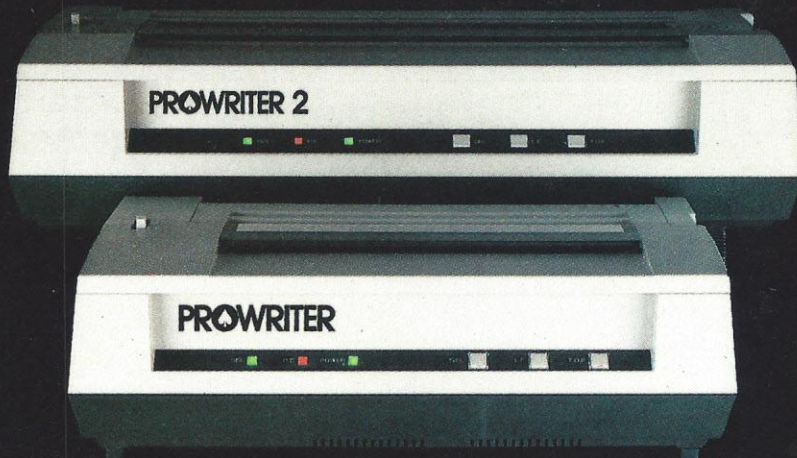
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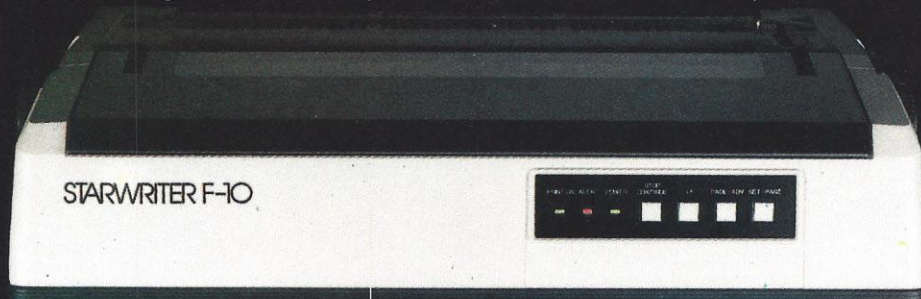
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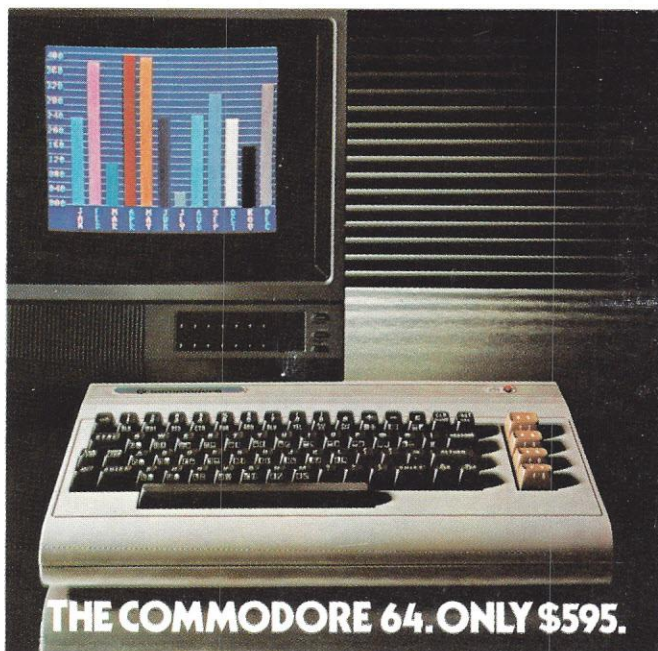
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